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THE "F.A.Q." CRITICISED, WITH A SUGGESTED ALTERNATIVE.

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"In view of the fact that a preliminary shipment of wheat—produced in the last harvest—was being made to London, the Committee appointed a Corn Committee consisting of Messrs. R. McClure, D. Milne, E. J. H. Nicholson and E. J. Hayes, to confer with a Committee of the Fremantle Chamber, consisting of Messrs. E. A. Allnutt, W. H. Evans and F. C. Feely, to adopt an F.A.Q. (fair average quality) sample of Western Australian wheat. Samples of wheat were collected from many districts and, after careful examination and weighing, the standard sample for the harvest 1904-5 was fixed at 62 lbs. weight to the Imperial bushel. This information was sent by cable to London and was communicated to the local Chambers interested and also to the London and Liverpool Corn Trade Associations, to which bodies also sample bags were sent and acknowledged as having been adopted by those associations. In view of the fact that in all probability a surplus of wheat will now be available for export each year, the Chamber proposes to fix an F.A.Q. sample of wheat annually."* So runs the record of the fixing of the first commercial standard for trading in Western Australian wheat.

It will be noted from the opening sentence of this record that it was the export of wheat which brought about the necessity for a trading standard being fixed. Prior to this, and whilst all our wheat was absorbed by the local market, the wheat could be and was sold by sample, *i.e.*, its quality could be judged by a fair sample shown to, and examined by, the buyer at time of purchase. Immediately, however, the personal contact between buyer and seller was broken or became impossible—as in the case of wheat sold for shipment overseas—then a commercial trading standard became necessary in order to smooth out the difficulties incident to trading when long distances separated the seller and the buyer. Such standards are obviously essential in order that buyers, who cannot inspect

* The Fifteenth Annual Report of the Perth Chamber of Commerce for the year ending 30th June, 1905.

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the wheat offered for sale, may have indicated to them in a reliable, understandable and definite manner and, at the time the wheat is offered for sale, the quality of the wheat they may expect to receive after purchase. Because of the necessity for the adoption of a trade standard, which arose consequent upon the inauguration of the export wheat trade, following the evolution of our wheat industry with its expanding production, trading by sample in Western Australia gave place to trading under the F.A.Q. standard. The F.A.Q. standard, by which wheat is at present bought and sold throughout Australia, is so-called, because the letters F.A.Q. are the initial letters of the three words in the term "Fair Average Quality," and by custom have become recognised as the commercial abbreviation for that term, and also because it is supposed to represent the fair average quality of the crop of the particular season for which it is fixed.

The F.A.Q. standard was not the only standard which could have been adopted. Obviously, as the export trade was principally with Britain, the standard should be, and was, one of those which were adopted in the contracts recognised by the London Corn Trade Association, *i.e.*, by the body controlling sales of commercial wheat made through London. There are, however, some 60 contracts recognised by that body for the sale of wheat from countries exporting to London. According to Duly* these contracts fall into four groups, as far as the clauses dealing with quality are concerned. In these the quality of the wheat sold is—

(1) About as per sealed sample;

(2) About as the F.A.Q. made in the exporting country:

(3) About as the F.A.Q. made in London and in Plate contracts of a specified weight per bushel;

(4) According to the official certificate at port of shipment and which is final.

In adopting the standard according to the second group, the Chambers of Commerce in Western Australia fell into line with the practice which was followed in the Eastern States.

It is not known when the system of selling according to this F.A.Q. standard was first introduced, but probably it originated in South Australia about 1870.† It was then adopted in Victoria and later in New South Wales.

Although there is an independent standard for each wheat exporting State, the procedure adopted in fixing the F.A.Q. standard is practically the same throughout the Commonwealth. As the standard fixed relates to the crop of a particular season only, it is necessarily fixed annually.

In Western Australia the practice commenced in 1905 has been continued, and the fixing of the standard is undertaken jointly by the Perth and Fremantle Chambers of Commerce, who bear the expense in connection therewith. The actual proceedings take place in alternate years at the headquarters of each Chamber. Last season the standard was fixed in Perth, this season in Fremantle. The President of the Chamber at the headquarters of which the proceedings are carrried out is for the time being in charge of the function, and is assisted by leading wheat traders of the State, who comprise the grain committees of both Chambers.

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* "Grain," 1928.

† At the conference of wheatgrowers convened by the New South Wales Department of Agriculture, and held in Sydney on July 18-21st, 1910, Mr. J. M. Paxton, for many years Chairman of the Grain Section of the Sydney Chamber of Commerce, stated "South Australia was the first State to adopt the principle (F.A.Q.) and that must have been at least 40 years ago.

Until the season 1928/29 the F.A.Q. standard was fixed from representative samples collected by the Chambers of Commerce from centres at which wheat was delivered throughout the wheat-growing areas. These samples were in the proportion of 1 lb. for every 800 bags (2,400 bushels), which had been delivered up to about the 20th January. Obviously the sample so collected should have been a fair average one of the wheat delivered, but it was contended, and with some justification, that in some instances the samples were picked ones, the object in these cases being a worthy desire to advance the interests of the district. Since then (1928/29) the practice has been to collect the necessary samples from the wheat received at the different ports from which West Australian wheat is exported.

In order to obtain the F.A.Q. standard, wheat samples from each port are mixed together, the weight of the sample used from each port being relative and proportionate to the estimated current season's production of the wheat zone served by that port. After the samples have been thoroughly mixed the natural weight of the Imperial bushel is ascertained with the utmost accuracy. Until the present year it has been the custom to ascertain the bushel weights of the samples received from each port zone, but no good purpose having been served by this practice it is being abandoned and the bushel weight for the State as one unit only is to be determined this year.

As the result of 20 years' intimate association with the actual work of fixing the F.A.Q. standard in Western Australia, it is unreservedly stated that it is impossible to conceive of more careful methods being used for the determination of the bushel weight.

After the actual bushel weight has been ascertained, the Committee, in view of the information available, because of their examination of the samples received and their personal experience of the quality of wheat being delivered by farmers, then consider whether the actual bushel weight shall be subject to any "draft" deduction (ranging from ¼ to 1 lb.) before being declared.

The object of this "draft" deduction is to minimise risk of arbitration, which is the right of the British buyer, should he consider that the cargo, as supplied, is not quite up to "standard." The soundness and equity of reducing the bushel weight which has been ascertained with such meticulous care has on more than one occasion been questioned and discussed. The object of its advocates is commendable, in that it is to ensure that the wheat delivered shall be at least equal to, and probably better than, the quality offered at time of sale. This attitude ignores the fact that the contract provides that the wheat sold is "to average at time of shipment *about* equal to the official standard of the State whence shipment is made," and in consequence the F.A.Q. is a standard or measure by which the quality of a particular cargo can be evaluated. Just as a carpenter ascertains the length of a piece of timber by comparison with his "rule," so the quality and, therefore, the value of a parcel of wheat is ascertained by comparison with the F.A.Q. standard. It will thus be seen that, when a shipper sells a parcel of wheat according to the F.A.Q. standard, it does not mean that he is legally or morally bound to supply wheat of F.A.Q. quality, but that, if the quality delivered to below that standard, then the necessary adjustment shall be made, and this is provided for in the contract of sale.

Seeing that such provision is made in the contract relating to wheat sold according to the F.A.Q. standard, the seller cannot be considered dishonourable, as advocates of the draft adjustment believe, if the wheat delivered is not equal to the quality of the F.A.Q. standard. To be equitable the contract should also provide for an adjusting payment by the buyer when the quality is better than the standard. The effect of such a one-sided arrangement as obtains is that, in

order to avoid arbitration adjustments, the wheat shipper unconsciously desires to have the F.A.Q. standard rather lower than the actual quality of the crop.

The benefits of this draft reduction are one-sided and definitely against the producer of wheat which is above the average as declared, with no benefit even to those whose wheat is on the line or below it. The advantage to wheat shipper and overseas purchaser is that it tends to reduce friction between them by presenting the latter with a bonus of better quality than was arranged and paid for.

Unnecessary Unmillable Material in the F.A.Q. Standard—Foreign Matter, Chaff and Backbone.

In the 1933/34 F.A.Q. standard, after allowing for 1% as a reasonable quantity of total unmillable material, this forms about 0.4% of the total, and in a 50,000,000-bushel harvest (4,000,000 bushels retained on farms), this amounts to about 5,000 tons.

Why pay freight and other charges on what is useless to the miller?

When the decision regarding the standard is made, a declaration as hereunder is signed by the members and officials present. The declaration for this season read:—

"We, the undersigned, present at the Chamber of Commerce, Fremantle, on Wednesday, January 31st, 1934, at the fixing of the weight of the standard bushel of F.A.Q. Western Australian wheat for season 1933/34 hereby certify that it was fairly taken, and the weight fixed, namely 61½ lbs. per Imperial bushel, in our opinion, is the proper weight for the season 1933/34."

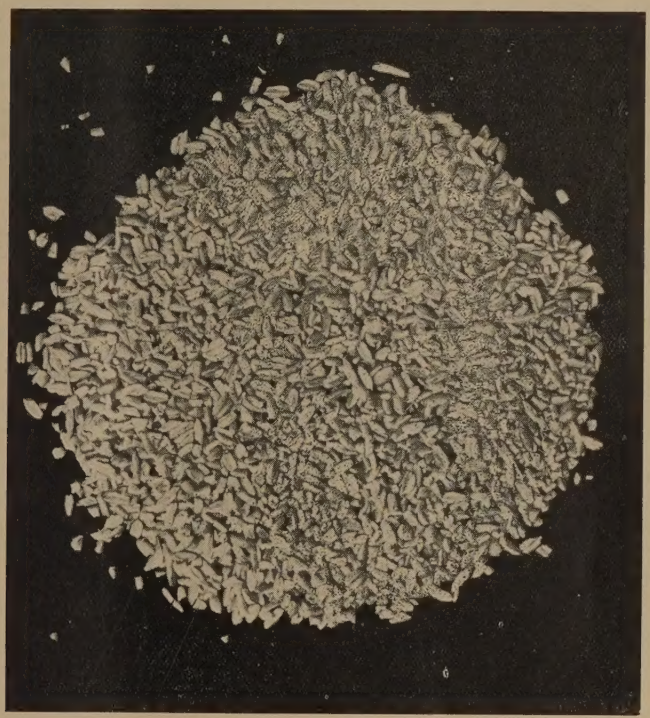
It is now pertinent to consider how this standard suits the requirements of—

1. The overseas purchaser, *i.e.*, ultimately the miller;
2. The Australian wheat merchant and shipper, and
3. The wheat-grower.

The overseas miller requires to know—

1. The kind of flour the wheat will produce, and
2. The quantity of flour obtainable from a given weight of a consignment of wheat.

Provided the wheat is normal the fact that the standard is for Western Australian wheat will indicate to the buyer the kind of flour he can expect to obtain.



Unnecessary Unmillable Material in the F.A.Q. Standard—Fine Unmillable Screenings.

In the 1933/34 F.A.Q. standard, after allowing for 1% as a reasonable quantity of total unmillable material, this forms about 2.6% of the total wheat, and amounts to about 32,000 tons in a 50-000,000-bushel harvest (4,000,000 bushels retained on farms). It is doubtful whether these screenings are paid for, but they can be used to excellent advantage on the farm for stock.

Is it sound economics to pay freight and other charges on unmillable material?

The scrupulous care taken to ascertain the bushel weight of the standard is based upon the assumption that the quality of flour obtainable from a parcel of wheat is indicated by its bushel weight. This is only partly true. The quantity

of flour which may be obtained from a parcel of commercial wheat depends upon the clean millable grain it contains and the character of that grain. The bushel weight will indicate to a limited extent the percentage of unmillable matter in the grain. Under some circumstances, however, it may be entirely misleading. To illustrate this, two samples of commercial wheat were prepared, the bushel weights of which were respectively 62½ and 61½ lbs. If the highest bushel weight always indicates a lower percentage of unmillable material, then the sample weighing 62½ lbs. per bushel should have more millable grain than that weighing 61½ lbs. The reverse, however, was the case, the wheat of the lower weight actually contained nearly 1 per cent. (actually .8 per cent.) more millable grain than the other. The quality of the cleaned or dressed millable grain in each case was identical.

Another instance of a variation from this generally accepted rule is that recorded by Mr. F. L. Shier, B.Sc. (Agr.), in connection with some investigations carried out by the Wheat Branch in 1926.* It was found that a mixture consisting of 99½ per cent. of prime grain and ½ per cent. of unmillable material ("chaff") had a bushel weight of 62⅝ lbs., and a mixture of 94 per cent. of the same prime grain and 6 per cent. of unmillable material ("screenings") had the same bushel weight; that is to say, the former with over 5 per cent. more millable grain had the same bushel weight as the latter.

To remedy the defect in our F.A.Q. standard it will be necessary to ascertain the bushel weight of the millable grain in the commercial grain and not of the commercial grain itself. This would not be difficult, and its effect would have another very distinct advantage, for the quantity of flour which may be milled from the same variety or type of wheat will increase with the increase in the weight per bushel of cleaned wheat. Thus, the prospective buyer, when supplied with the bushel weight of the cleaned grain, would receive very definite information regarding the quantity of flour he could expect to obtain from it, a very important index of its value. To rely upon the bushel weight of commercial wheat to indicate the amount of millable grain it contains, and the quantity of flour which may be produced from that grain, is like relying upon an indifferent clock for the correct time when a chronometer is available. Just as the man with the poor timekeeper has to make allowances for contingencies if he has trains to catch, so he who buys wheat according to an indifferent standard has also to make allowances for contingencies, and such allowances will be invariably borne by the producer.

Our F.A.Q. lamentably fails when the information regarding its quality is required early in the season. How can we obtain an average of the crop until most of it has been harvested and much of it sold? It is impossible for the F.A.Q. to meet this requirement; the very nature of the standard requires that a large proportion of the season's crops shall have been harvested before the standard can be fixed, and, in consequence, the determination of the standard has to be delayed for at least two months after wheat deliveries have commenced. This delay is unavoidable whilst such a standard is retained. This feature was most unfavourably commented upon by the President of the Liverpool Corn Trade Association in March, 1923, when addressing the Australian editors then touring Great Britain. He pointed out that one of the troubles of the trade in Liverpool (which, of course, applied to other parts of the United Kingdom) was the delay which occurred in connection with the forwarding of standards of the new Australian crop. He further stated that it was then March, and the standards had not been received, although the cargoes sold according to those standards

* W.A. Journal of Agriculture, September, 1926.

had arrived. In consequence of this defect, as evidenced by the complaint just referred to, it is only reasonable to assume that the buyer has to make an allowance for contingencies. Suppose that this, and the allowance consequent upon the unreliable information supplied by the bushel weight of the uncleaned grain amounted to only 1 per cent., the total loss to growers on a crop of 50,000,000 bushels at 3s. 4d. per bushel would amount to between £70,000 and £80,000.

Despite the shortcomings of the F.A.Q. standard and his objection, consequent upon them, to it, the British importer is reluctant to agree to an admittedly better system. This is because he fears that the introduction of any new commercial trading standard will cause him to lose the right, which under the present system he possesses, of submitting to arbitration claims regarding quality after the arrival of the wheat in Great Britain. This aspect of this question was brought up by the Hon. W. F. Dunn, Minister for Agriculture, New South Wales, after his visit to England in 1925 and consequent upon the legislation enacted in connection with the introduction of bulk handling in that State powers were available to fix wheat standards. Speaking on the desirability of a change from the F.A.Q. to permanent standards at the conference of the Ministers of Agriculture held in Adelaide in 1927, he said, *inter alia*:—

> "I realise any change of this kind to a permanent can only be brought about very gradually. We passed legislation nearly 12 months ago in regard to bulk wheat standards as a result of my visit to the Old Country, where I ascertained our wheat was sold under the F.A.Q. standard, and a man who grew wheat of doubtful quality, or unclean wheat, received the same price or even better, than he who grew clean and good wheat. I had great difficulty in persuading the powers at the other end to agree we should standardise our wheat. Requests had been made time and again to the members of the Millers' Association whom I met in London, and we found they were hostile; they wanted to retain the present system whereby they arbitrated upon the quality of that wheat which they considered was not satisfactory.
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> "We had a very great fight with the English and Irish millers whom we met in London, and they said they had broken every attempt by every other country, excepting Canada, to abolish the right to arbitrate in Great Britain. Canada enforced the condition of weight and quality to be fixed at port of shipment. But they broke the back of the Eastern States of America when they tried to enforce the same condition.
>
> "Finally, they did agree that we should set standards, but not too many, say two or three at most. They expected they would receive samples in advance and that the standards would remain constant for many years so that they would then know what they were going to receive. Finally, they were quite agreeable to accept our proposal for permanent standards, but it took a great deal of persuasion.

From the West Australian wheat merchant's standpoint it is difficult to discover any serious defects in the present standard. The inability to fix the standard early in the season is a defect to both the merchant and the producer, but only of minor importance. This is because past experience has taught them, within limits, what to expect and that, except for slight variations in the percentage of the foreign matter, there is little difference between the standard from year to year. An examination of samples of the grain of the F.A.Q. for the seasons 1928/29-1933/34 will disclose little essential difference between them. From the West Australian shippers' standpoint the F.A.Q. standard may be regarded as satisfactory as any commercial standard can be. Except for the amount of unmillable material it contains, it may be regarded almost as a permanent standard.

The producer of wheat containing less, or no more, than the average amount of unmillable matter has little to complain about in connection with the present standard. The grower of average wheat receives its value, and though the grower of the lower grade may be subject to a dockage, some dockage can only be regarded as equitable. The grower of superior wheat containing less than the average amount of foreign matter is, however, at a serious disadvantage, and, indeed, is unfairly treated, in that he does not receive the cash premium for superior commercial value. Thus, the incentive to the improvement of the merchantable quality of the main crop is removed, and the careful farmer who desires to produce as properly cleaned a sample as is practical is discouraged rather than encouraged. In fact, unless the price for F.A.Q. standard is less than parity the premium which should be paid for the better wheat is distributed amongst the growers of average and inferior wheat, and they are therefore being paid more than they are entitled to at the expense of the more careful farmers. This is not only unfair, but it removes the incentive to improvement. This lack of incentive tends to reduce the efficiency of our best farmers in the harvest field to a dead level of mediocrity, or worse.

Because of the lack of incentive, farmers do not utilise to the best advantage the engineering skill used in the construction of Australian harvesting machinery. Because of the excellence of this machinery it is believed, after allowing for difficulties inseparable from field work, that the grain can be so "dressed" or cleaned that no more than 1 per cent. of screenings or other unmillable material need be left in it. The F.A.Q. standard allows for nearly four times this amount—in 1927/28 it was 5.5 times—and in consequence many farmers now cover up or remove the tailing screens from their harvesters, whilst the more scrupulous ones allow them to become choked, thus deliberately lowering the commercial value of our main agricultural product by including a much larger percentage of unmillable material—foreign matter and screenings—than is necessary. Though some of this may be of use to the miller for making bran and pollard, it is very doubtful if the farmer gets paid for it.

Not only is the present standard unfair to the good and careful farmers, but it also entails a loss to every wheat farmer, consequent upon the cost of the handling and transport of unnecessary material. Some idea of the enormous and unnecessary aggregate waste to the State consequent upon the unnecessary non-millable material in the F.A.Q. standard may be estimated from calculations hereunder, which indicate the amount of wasteful tonnage and cost of handling same in a West Australian crop of, say, 50.000,000 bushels, and an Australian crop of 200,000,000 bushels:—

ESTIMATED LOSS DUE TO THE TRANSPORTING (EXCLUDING HANDLING CHARGES) OF 3% UNNECESSARY UNMILLABLE MATERIAL IN THE F.A.Q. STANDARD.

Western Australia.

Harvest—50,000,000 bushels:

Exports (as wheat and flour)	43¼ million bushels
Home consumption (flour)	2¼ million bushels
Retained on farm	4 million bushels

Export—43,500,000 bushels:

3% of this = 1,305,000 bushels = approx. 35,000 tons

	£	£
Sacks—435,000 at 9s. per dozen	16,313	
Cartage—35,000 tons at 5s. per ton	8,750	
Railway Freight—35,000 tons at 12s. per ton	21,000	
Sea Carriage	52,500	
		98,563

Home Consumption—2,500,000 bushels:
3% of this = 75,000 bushels = approx. 2,010 tons

	£	£
Sacks—25,000 at 9s. per dozen	938	
Cartage—2,010 tons at 5s. per ton	502	
Railway Freight—2,010 tons at 6s. per ton ..	603	
		2,043
Total		£100,606

Total—	£
Export	98,563
Home Consumption	2,043
	£100,606

It will thus be seen that the loss incurred amounts to over £100,000; add to this the sum of £75,000, the estimated loss due to contingencies, and we have a total of £175,000 borne collectively by the wheatgrowers of Western Australia, most, if not all of which, it is believed, can be saved if the growers make up their mind to demand a change in our standard.

Australia.

Harvest—200 million bushels:

Export	150 million bushels
Home consumption (flour)	30 million bushels
Seed, feed, etc.	20 million bushels

Export—150 million bushels:
3% of this = 4,500,000 bushels = 120,540 tons

	£	£
Sacks—1,500,000 at 9s. per dozen	56,250	
Cartage—120,540 tons at 5s. per ton ..	30,135	
Railway Freight—120,540 tons at 12s. per ton	72,324	
Sea Carriage—120,540 tons at 30s. per ton ..	180,810	
		339,519

Home Consumption—30 million bushels:
3% of this = 900,000 bushels = 24,108 tons

	£	£
Sacks—10 million at 9s. per dozen	11,250	
Cartage—24,108 tons at 5s. per ton	6,027	
Railway Freight—24,108 tons at 12s. per ton	14,465	
Sea Carriage—24,108 tons at 30s. per ton ..	36,162	
		67,904
Total		£407,423

Total—	£
Export	339,519
Home consumption	67,904
	£407,423

If to this be added the estimated loss of 1 per cent. for contingencies amounting to some £300,000 we have the enormous sum of over £700,000.

Briefly, the defects of the present F.A.Q. Standard are—

1. It cannot be fixed early enough to suit overseas buyers.
2. The natural bushel weight of the commercial wheat is not always a true index of its merchantable quality.
3. It is unfair to the careful farmers who should be encouraged.
4. Its incidence is the cause of great economic waste.

The first two defects could be remedied by the adoption of a fixed standard stating the natural bushel weight of the millable grain. The other two defects would be partially remedied also by the adoption of a fixed standard, if the latter provided that the percentage of millage grain should be in excess of that now found in the F.A.Q. The whole of the defects would be remedied by the adoption of—

1. Selling by grade as in Canada and the United States of America.
2. Selling on a "Clean Wheat" basis and according to the actual bushel weight of the millable grain in the parcel.

Already, as the result of the advent of bulk handling in New South Wales, murmurings are heard about the advisability of introducing the system of selling our wheat according to grades. It certainly has the advantage that such a system very accurately assesses the value of the different types of wheat contained in a country's crop, but such a system is necessarily complicated and unnecessarily complicated for Western Australia, where the types of wheat grown are all very similar and have in common with each other such flour characteristics as colour, brightness and dryness, the greatest difference in any characteristic would be in strength. The extent of this difference need not prevent the very strong varieties being mixed with the softer ones, provided due recognition was made of their relative monetary value, or, if desired, the very strong varieties could be kept separate as premium wheats, as is the practice at present in some instances.

The present plan of having one class common to all varieties rather than several grades is simpler and suits West Australian conditions. The plan of selling on a "Clean Wheat" basis is, therefore, preferred to that of selling according to grades. Its underlying principle is that a parcel of wheat would be sold according to the "clean" wheat it contains. This would be in line with the sale of milk according to test, and the sale of wool according to its yield of clean scoured wool. On the "Clean Wheat" basis all producers would be treated fairly, but those who produced the cleanest wheat would receive the greatest monetary return and this would, in consequence, encourage the greatest efficiency in harvesting and cleaning the grain; this, in its turn, would have the effect of minimising the enormous economic loss due to handling and transporting unnecessary unmillable material.

Dealing on a "clean wheat" basis would not remove the right, so dear to believers in British justice, to arbitrate in cases where the buyers have doubt as to whether the quality of the grain they are receiving is equal to that offered for sale prior to purchase. It would, however, remove two of the principal defects associated with the right to arbitrate under the present F.A.Q. system, viz.:—

(a) The unreasonable delay which may take place in connection with the arbitration; and

(b) The risks attending arbitration based upon *personal* opinion of the individual.

In order to safeguard the buyer for the inconvenience and risk of having to purchase wheat during the greater part of the season according to a yet unknown standard, the right to arbitrate has had to be extended to an unusual extent, and, in consequence, the claims for arbitration can remain in abeyance until 21 days later than the receipt of the F.A.Q. standard sample. It can thus happen that final payment regarding the sale of a wheat cargo may remain in abeyance for three or more months after the sale has been made. Such a condition cannot be regarded as satisfactory, and it would be difficult to find any other commodity of importance subject to such trading conditions.

Dissatisfaction will always exist whilst disputes as to quality rest solely upon the personal opinion of any individual, however skilled and experienced he may be. This is especially the case when the shipper has no definite information, as at present, regarding the basis on which the arbitrator forms his opinion. Though it is admitted that, as the result of many years of experience, some men become remarkably skilful in assessing the relative values of two parcels of commercial wheat, yet such a method is no longer in accordance with the progress which has been made in connection with our knowledge of wheat and its value for milling. During comparatively recent years a great deal of investigational work has been carried out in connection with the milling properties of wheat, and information is now available so as to provide a "technique" whereby the samples of the parcels in dispute can be dissected into their component parts, and their milling value, *i.e.*, their commercial worth evaluated, on a much sounder basis, and, to the disputants, on a more satisfactory one, than an expression of opinion as the result of "matching." It is now possible to assist the skilled judgment by simple and accurate tests, in much the same manner as the bushel weight of a small sample of wheat is determined, not by empirical means, but a specially devised instrument called a chrondometer.

In 1921, the writer first called attention to the defects of selling wheat according to the F.A.Q. standard, and in 1926, consequent upon announcement that the Minister for Agriculture in New South Wales intended to introduce permanent standards for dealing with the New South Wales wheat crop, a paper was read before the Australian Association for the Advancement of Science at the Perth meeting on 27th August, 1926,* suggesting the terms to be used in connection with such standards and defining the character of same. In 1929, having realised by then the objections to two or more selling standards for Australian wheat, the use of a permanent standard limiting the amount of foreign matter to 3 per cent. was advocated as an improvement upon the existing method. To deal on a "clean wheat" basis is on similar lines but goes somewhat further in the direction of eliminating unnecessary foreign matter and unmillable material from our commercial grain, but it conforms to custom and retains the term "F.A.Q." for the clean grain and in consequence the commercial advantages attaching to trading in accordance with an F.A.Q. standard.

Dealing on a "Clean Wheat" basis would, in effect, be dealing according to a permanent standard, which would be available as early as required in any season. Selling on a "Clean Wheat" basis would make it easy to adopt the provision of selling also on the basis of the bushel weight of the cleaned wheat in each parcel. This would be in line with the excellent practice of selling wool according to its quality, as well as according to its yield on a "clean" basis. There is nothing revolutionary in this proposal. It is not new as far as some countries are concerned; export wheat from Canada and the United States is sold on a "Clean Wheat" basis, as also, it is believed, is wheat from India, and as already pointed out, the London contracts for the sale of wheat from South America provide that the bushel weight of the parcel shall be specified. Nor would it be a serious departure from our present practice. At present the local buyer estimates how closely the parcel of wheat submitted by the farmer approaches the quality of the F.A.Q. standard. Unconsciously he estimates the percentage of the unmillable grain and the bushel weight of the uncleaned grain. So, if our wheat were purchased on a "Clean Wheat" basis, the local buyer would soon learn to estimate, with considerable accuracy, the percentage of millable material in the sample and its bushel weight. In case of disputes the amount of

* "The F.A.Q. and other Commercial Standards for Trading in Australian Wheat" Journal of the Department of Agriculture of W.A., September, 1926.

unmillable material would be accurately determined by suitable sieves, or a special machine, and the bushel weight by the chrondrometer. In the United States of America the unmillable material is determined by a small machine resembling a winnower, known as a "kicker." In Australia it is probably a slightly different type of machine, which included a Carter disc separator and a circular screen, would be more suitable.

The suggested alternative to the F.A.Q. would certainly be an advantage to both buyer and seller, for it would state the amount of millable grain purchased, and it would indicate in a reliable and definite way, the quantity of flour which could be produced from a given weight of that wheat. Apart from the slight derangement inseparable from the introduction of any new plan, the alteration would present no special difficulties and, once introduced, would work just as smoothly as the present method, but with greater fairness to the producer and, it is believed, with more satisfaction to the buyer.

SHEEP AND WOOL NOTES.

Hugh McCallum, Sheep and Wool Inspector.

With the wool season practically over, it might be well to review the past four years, and see how we have fared regarding the production of wool. There has been a great demand for wool by every manufacturing country, and the outlook for the future is particularly bright and important from the point of view of sheep husbandry. Therefore the greatest care in the production of wool must be exercised by all concerned in the breeding of our sheep so that only the best possible is produced, which will meet with ready sale to oversea buyers.

During the period when sheep and wool were low in value, many flock owners neglected their sheep by the purchase of "scrub" rams, breeding their own rams, permitting the rams to run with the flocks from shearing to shearing, inbreeding, neglecting to cull, failing to dip to keep the flocks free from infestation, and by lack of feeding. An unfortunate attitude, no doubt, but sheep were unsaleable and wool of little value. During the period under review, however, some farmers took the opportunity to cull heavily, selling the undesirables at any price and replacing them with high grade ewes. These farmers have reaped their just reward.

Every district in this vast State has some particular advantage or disadvantage besides climate, and these peculiarities all help in the production of the different types of wool displayed on the floors of the wool warehouses. The best will always be obtained by a good breeder simply because he is watchful for improved results, and knows when to stop or continue, as the case may be. We are producing at present a large quantity of good wool, a credit to the growers, but we are also growing a large quantity of wool that is uneven in fibre and this principally is due in many cases to a lack of general knowledge. There are outstanding cases of many being too anxious to get to the top by "short cuts."

Many farmers purchase several rams from different studs and in most instances they have not had satisfactory results because they have not kept to one blood. Some sheep men have used long stapled rams that shown an open back, on dense-stampled ewes with bad results. In many flocks the result of such breeding can be seen, and if the wool is carefully opened, many of the staples are

found to be uneven in length of the fibre, caused by the attempt to combine the characteristics of sire and dam Such breeding leads to irregularity in the fleece and lowers the value of the wool by having too many qualities of wool in the one fleece. Breeding on the lines stated above has a further great objection in that cross fibres may be produced.

AVOID EXTREMES.

It is of the utmost importance to be careful when mating rams, that extremes are not blended, either as regards length of staple or quality of wool. Improvement can only be effected by a gradual process and it is just as much to be observed in breeding flock sheep as it is in the breeding of the studs. In fact, it is most important with the flocks large or small, for from here is where the bulk of the wool comes; it is from this that the buyers judge for value. If the sheep breeder finds he is losing length, or the wool is becoming too open, he should discover the cause. It is a mistake to think it can be rectified by simply obtaining a ram with characteristics that may suit the purpose, from another breeder. Stick to the blood you have and then try and get a ram with moderately greater length and density as the case may be, and gradually work back to what is required. Changing the blood often only aggravates the offence, so to speak, besides opening the way to other faults.

BREEDING FROM IMMATURE SHEEP.

Many so-called farmers still continue to run the rams with the ewes throughout the year; why, it is hard to understand. They often admit the mistake. Breeding from stock that is too young is often done, and this is one of the many causes of deterioration, both in constitution and frame. Another mistake is to expect the rams to serve too many ewes. Rams should not be used until they are twenty months old. A good old ram is better than a bad young one. Young ewes are generally bad mothers compared with older sheep. One of the drawbacks in breeding from ewes that are immature is that they are only maturing themselves, and will often neglect their offspring, besides which their organs are not sufficiently developed to enable them to lamb easily. Losses often occur, both of the mother and the young.

MATING.

Farmers often find that when the rams are joined to the ewes, they will not work. With British breeds it is often that they are too fat, or that both the ewes and rams are carrying too much condition. Rams and ewes should be in fair condition. Over-feeding is often detrimental to a successful lambing. If the farmer thinks the ewes have not all been served, he may keep the rams in a little longer. Some of the ewes may "come on" and take service, although the lambs would be a little later than the others. Still the ewes are breeding, and a lamb is of value to-day. Before joining the rams to the ewes both should be inspected and the ewes examined to see that they have no dags or dirt hanging to their wool.

In the early part of the summer the eyes of the sheep should be examined for blindness, and their feet, if they have grown too much, should be cut back. Very often the sheep man neglects attending to the feet. This work would save a great deal of lameness.

BREEDING EWES AND THEIR CARE.

Breeding ewes should receive the best of feed and should be kept in good condition throughout the year. It is to these ewes that the farmer looks for the improvement in his flock. Neglected ewes cannot breed good lambs. If the ewes have done well, the lambs will drop strong and healthy, and the ewes will be able to rear them on a plentiful milk supply. Ewes in lamb should never be driven far or fast. Crushing through gates and the flock being dogged should at all times be avoided, as abortion may take place.

Before lambing, and especially in districts where the blow-fly is troublesome, it is very necessary to "crutch" the ewes. When lambing occurs this will prevent damp, dirty wool attracting the blow-fly.

LAMBING.

The lambing season is a busy time of the year, and certainly the most critical. The percentage of lambs raised will depend largely upon the care and patience of the farmer. Arrange the work if possible so that considerable time can be spent amongst the flock during the time of lambing. The object of every farmer should be to increase the percentage of lambs. Losses during and after lambing are very high.

WEANING THE LAMBS.

Lambs are usually weaned when about five months old. However, the correct time will depend largely upon conditions. If the season is bad it will pay to leave them rather longer with their mothers. Ram lambs must be weaned earlier, or they may give trouble with the ewe lambs. When the lambs are taken from the ewes, it is wise to put in a few dry ewes with them. The old sheep will steady them and lead them to water. Young lambs are timid and easily frightened, may not feed and hang in corners. The young sheep must never receive a set-back.

THE BLOW-FLY MENACE.

The mortality amongst sheep from attacks of the blow-fly is becoming more serious every year than the sheep farmers are aware; individually they are doing their best to eradicate this pest, but unless some general action is taken it will prove sooner or later to be the greatest danger to the pastoral industry. Flies deposit their eggs on the wool of the sheep, and as the excrement accumulates and putrifies around the tail, they will be first deposited there, or on any wound. The maggots are scarcely hatched before they burrow under the skin and torment the sheep by the severity of their bites. It may be useful to the beginner with sheep to know the symptoms of the sheep affected:—Sheep hanging down their head, stamping their feet, shaking their tails, running and biting themselves, and, in the case of rams struck on the belly, trying to scratch themselves with their hoof. The injured parts should be carefully treated and they will soon heal. Leaflets on treatment and prevention are available from the department.

FAT LAMB RAISING FOR EXPORT.

Excellent results have been obtained overseas for lambs bred in the State, and providing preparation is made by other lamb breeders for more attention to detail, the export trade will increase; only the best will do. While relying on the ram for the larger number of suitable points from the buyers' point of view, it must be always remembered that the ewe makes the fat lamb. She must be not only prolific, but essentially a heavy milker, for the lamb must never receive

a check after birth. The ewes should always have a balanced ration from the different fodders that can be grown on the farm, varying in character according to the season.

When handling the lambs prior to forwarding them to market, no unnecessary roughness should be used, so as to avoid the rejection percentage, as bruised lambs mean lower prices.

It is regrettable that a few years ago many farmers rushed into this business without due preparation, and naturally they did not enjoy success. They started on the wrong lines. Uneven nondescript ewes cannot produce the uniform type of lamb the trade demands; ewes must be of sound constitution and good conformation. It is regrettable that many unscrupulous dealers (not breeders) disposed of large numbers of rams of doubtful pedigree to farmers who had no previous experience in lamb breeding. It is best to purchase requirements only from registered stud breeders who have a reputation to maintain. It must not be forgotten that the oversea market is still a predominate factor in the disposal of the best lambs, that good feeding and climatic conditions will grow them to maturity during a comparatively short period. Quick transport to market is necessary, as no class of live stock loses weight like lambs. The breeder in this branch of sheep husbandry must be ever watchful from the time they are dropped until they are marketed.

MIXED FARMING.

Recent experience in the wheat farming industry is inducing more men on the land to go in for sheep and wheat, as a surer means of securing payable returns. In this State there has been too many wheat-growers and not enough mixed farmers. No wheat-grower can utilise the whole of the area to the best advantage without sheep. Sheep are a very necessary part of a farmer's plant in helping to keep the paddocks clean, and by combining the two, should there be a failure in the wheat crop, the sheep are a good stand-by. Wool prices are good and sheep, if purchased rightly, are one of the best investments for the man on the land. But they must not be allowed to lose their commercial value through lack of correct feeding during the late summer and autumn. To provide the reserves of feed at the lowest possible cost, they should be grown on the farm.

"THE JOURNAL OF AGRICULTURE"

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HERD TESTING.

THE OFFICIAL AUSTRALIAN PURE BRED DAIRY CATTLE PRODUCTION TESTING SCHEME, 1933-34.

Conducted by Dairy Branch, Department of Agriculture, Perth.

Progress Report of Results to 31st January, 1934.

Name of Cow.	Breed.	Herd Book No.	Date of Birth.	Date of Calving.	No. of Days in Test.	Weight of Milk last day of Test.	Weight of Milk for period.	Average Test.	Butter Fat.	Owner.	Sire.
						lb.	lb.	%	lb.		
MATURE COWS (OVER 5 YEARS OLD)—STANDARD 350 LBS. BUTTER FAT.											
Koojan Bonnie Elizabeth ...	Guernsey...	1899	23-3-27	5-5-33	273	24½	9,253	6·2	570·97	A. W. Padbury ...	Robin of Nundorah
Grassvale Lady Fowler 3rd ...	Jersey ...	19111	20-5-25	6-5-33	273	22	9,036	5·5	494·84	R. H. Rose	Rye Duke of Glen Iris
Karridale Pride	Guernsey...	1981	15-10-27	26-3-33	273	27	9,306	5·1	477·79	G. E. Scott	Mennanurra Oliver Twist
Numbawarra Lulu	A.I.S. ...	4022	21-9-26	11-5-33	273	31	10,840	4·2	423·03	D. Bevan & Sons ...	Fairy's Fock of Fairfield
Springmead Barbara	Jersey ...	13295	20-2-22	9-2-33	273	31·5	9,228	4·5	417·47	Sabina Vale Stud Farm	Springmead Osram
Wooroloo May 2nd	A.I.S. ...	15145	25-10-26	22-10-32	273	19·5	8,518	4·7	403·07	Wooroloo Sanatorium Farm	Commercial of Blackheath
Nooka Pearl	Jersey ...	28189	2-12-27	6-12-32	273	20	6,930	5·7	400·64	S. P. Herbert ...	Jessie's King of Sarnia
Picture 8th of Raleigh ...	A.I.S. ...	17524	22-4-27	19-3-33	273	35	10,710	3·9	396·82	D. Bevan & Sons ...	Union Jack of Raleigh
Carnation of Minathorpe ...	do. ...	...	6-5-26	3-11-32	273	8	8,724	4·4	387·25	R. Bee & Sons ...	Bruce of Sunnyvale
Moorlands Agnes	Jersey ...	23680	11-6-26	6-5-33	273	12½	6,967	5·2	366·95	P. Rose	Colonel of Melrose
Claremont Biddy 8th	A.I.S. ...	17908	10-8-27	19-1-33	273	18	9,069	4·06	365·49	Hospital for Insane ...	Telyarup Prince of Claremont
Muresk Buttercup	Guernsey...	1799	19-4-27	26-6-29	273	21	7,008	5·2	363·99	Muresk College ...	Triumph of Wollambar
Roselyn 2nd of Raleigh ...	A.I.S. ...	17533	19-10-27	12-3-33	273	25	9,345	3·9	360·99	D. Bevan & Sons ...	Union Jack of Raleigh
Moorlands Bemil	Jersey ...	20885	2-8-25	23-4-33	273	12½	6,832	4·6	314·87	P. Rose	Colonel of Melrose
Elsie 4th of Raleigh	A.I.S. ...	17481	24-1-27	3-12-32	273	31	8,043	3·8	305·74	D. Bevan & Sons ...	Colonel of Melrose
Ethel 13th of Raleigh	do. ...	17489	9-9-26	27-10-32	240	14·5	6,570	4·3	282·45	D. Bevan & Sons ...	Barrister of Raleigh
Carnation 2nd of Minathorpe ...	do. ...	17939	18-5-27	23-11-32	210	21	6,570	4·3	281·76	R. Bee & Sons ...	Collier of Darbalara
Melba 48th of Darbalara ...	do. ...	14119	28-1-22	25-2-33	273	23	7,239	3·78	272·62	H. O. Timms ...	Kitchener of Darbalara
Diamond 3rd of Raleigh ...	do. ...	17472	19-11-26	20-12-32	240	22	7,170	3·8	269·91	D. Bevan & Sons ...	Union Jack of Raleigh
Springmead Hinemoa	Jersey ...	13296	6-8-22	23-11-32	273	18·5	6,910	3·9	268·32	Sabina Vale Stud Farm	Springmead Osram
Fairy Rye of Grass Vale ...	do. ...	2368	1-6-25	2-11-32	210	11	5,820	4·5	262·71	C. H. Ironmonger ...	Rye Duke of Glen Iris
Moorlands Blur	do. ...	24918	8-8-27	30-4-33	240	12	5,055	5·1	257·88	P. Rose	Grafter of Melrose
Koojan Lady Betty 4th ...	Guernsey...	1616	22-5-26	11-2-33	210	20	5,700	...	257·79	A. W. Padbury ...	Robin of Nundorah
Spurfield Air Girl 2nd	do. ...	1048	22-4 24	23-10-32	273	12	4,881	5·2	256·92	Muresk College ...	Milton Steadfast
The Flower of Telyarup ...	A.I.S. ...	14747	24-4-22	20 9-32	210	10·5	6,075	4·0	241·00	H. O. Timms ...	Carl of Blackheath
Springmead Lady Osram ...	Jersey ...	18295	2-11-23	11-1-33	273	18	5,709	4·2	240·10	Sabina Vale Stud Farm	Springmead Osram
Tabbagong Dove 5th	A.I.S. ...	4467	3-11-27	6-4-33	180	27	5,565	...	238·35	W. G. Burges	Daisy's Gift of Hillview
Muresk Carnation	Guernsey...	1800	30-5-27	29-10-32	240	15·5	5,040	4·7	235·53	Muresk College ...	Triumph of Wollongbar
Blackheath Milkmaid	A.I.S. ...	10091	9 7-18	6-10 32	240	9	6,210	...	233·79	H. O. Timms ...	Flower's Mayfield of Blackheath
Vanity 8th of Oakdale ...	do. ...	12931	0-12-19	8-1-33	273	16·5	6,259	3·7	228·39	H. O. Timms ...	Standard of Oakdale
Thelma of Blackheath	do. ...	14748	24 9-20	13-11-32	210	12·5	6,000	3·5	214·95	H. O. Timms ...	Flower's Mayfield of Blackheath
Della 11th of Oakdale	do. ...	9355	0-7-18	1-11-32	210	12	4,875	...	187·86	H. O. Timms ...	Courage of Oakdale
May of Wooroloo	do. ...	15144	18-8-25	15-5-33	90	28	3,195	...	141·93	Wooroloo Sanatorium Farm	Commercial of Blackheath
Muresk Lily	Guernsey...	1801	16-2-27	4-5-33	120	18	2,370	...	125·67	Muresk College ...	Triumph of Wollambar
Brookvale Noble Lily	Jersey ...	24894	19-8-26	28-6-33	90	27·5	2,475	...	106·74	G. F. Combs ...	Noble Lad of Roelands
Daisy of Glanavon	A.I.S. ...	Foundation	1926	13-2-33	90	33	3,075	3·5	106·44	D. Bevan & Son ...	

COWS OVER 4 YEARS AND 6 MONTHS AND UNDER 5 YEARS OLD—STANDARD 330 LBS. BUTTER FAT.

Nooka Carnation	Jersey ...	25218	17-5-28	14-12-32	273	26	8,283	5·8	464·21	S. P. Herbert ...	Jessie's King of Sarnia
Springpark Starbright's Queen	do. ...	24901	16-3-28	19-10-32	273	25	7,590	6·0	455·45	Robinson Bros. ...	Prince Marinora of Grass Vale
Denmark Rose Pearl 3rd ...	Guernsey...	1703	23-11-27	20-10-32	273	19	6,042	5·4	373·77	Denmark Stud Farm	Rose Chief of Wollongbar
Muresk Primrose	do. ...	2527	3-3-29	19-4-33	273	15½	5,956	5·4	324·10	Muresk College ...	Triumph of Wollongbar
Venus 8th of Raleigh	A.I.S. ...	17540	3-2-28	16-10-32	240	15½	8,370	3·9	323·78	D. Bevan & Sons ...	Royal Standard of Darbalera
Moorlands Celia	do. ...	23210	15-5-28	30-3-33	273	13	6,429	5·0	321·10	P. Rose	Colonel of Melrose
Moorlands Ceres	do. ...	23211	17-5-28	26-3-33	273	9½	5,593	5·4	306·29	P. Rose	Colonel of Melrose
Springmead Fern	Jersey ...	...	5-3-28	5-12-32	273	10	5,025	4·8	240·77	Sabina Vale Stud Farm	Springmead Islander

COWS OVER 4 YEARS AND UNDER 4 YEARS AND 6 MONTHS—STANDARD 310 LBS. BUTTER FAT.

Telyarup Duchess	A.I.S. ...	2504	9-12-28	4-3-33	273	42¼	13,792	3·8	522·84	A. E. Grant	Baron of Darbalara
Tipperary Pansy...	A.I.S. ...	2442	2-12-28	25-3-33	240	26	7,395	4·5	334·41	A. E. Grant	Villiers of Darbalara
Kurrawong Nancy 3rd	do. ...	...	9-3-29	29-4-33	273	15	7,320	4·2	311·43	D. Bevan & Son ...	Premier 2nd of Kurrawong
Moorlands Corona	Jersey ...	28228	15-11-28	3-5-33	240	8	4,620	5·6	251·88	P. Rose	Melrose Romeo
Tabbazong Society 7th ...	A.I.S. ...	1695	7-1-29	7-2-33	240	10	6,180	3·7	225·12	W. G. Burges ...	Daisy's Gift of Hillview
Lottie 5th of Kurrawong ...	do.	18225	8-11-28	11-2-33	120	24½	3,150	...	126·90	W. G. Burges ...	Premier 2nd of Kurrawong

COWS OVER 3 YEARS AND 6 MONTHS AND UNDER 4 YEARS OLD—STANDARD 290 LBS. BUTTER FAT.

New Park Amy 7th	A.I.S. ...	1865	14-6-29	31-1-33	273	34	10,902	3·7	409·07	W. G. Burges ...	Ruler of Greyleigh
New Park Sally 9th	do. ...	1873	30-4-29	4-4-33	273	23	10,839	3·9	399·58	W. B. Burges ...	Ruler of Greyleigh
Moorlands Duchess	Jersey ...	31239	11-7-29	5-5-33	273	13	7,134	5·2	364·11	P. Rose	Moorlands Romeo
Minnamurra Palm Olive ...	Guernsey...	2616	30-8-29	27-4-33	273	17	6,906	4·7	331·09	Muresk College ...	Caramana Favour
Tipperary Melba 3rd	A.I.S. ...	2358	11-10-29	12-4-33	273	21	7,863	4·0	318·12	R. Bee & Sons ...	Melba's Re Echo of Tipperary
Minnamurra Currency Lass ...	Guernsey...	2806	7-10-29	2-4-33	273	14	6,162	5·0	306·08	Muresk College ...	Caramana Favour
Nooka Wild Rose	Jersey ...	28191	31-12-28	28-12-32	240	17½	5,955	4·7	284·28	S. P. Herbert ...	Montrose East of Glen Iris
Banyule Silvermine 59th ...	do. ...	29033	10-2-29	23-12-32	273	21	5,973	4·6	274·60	Sabina Vale Stud Farm	Banyule Superstrain
Denmark Red Rose 3rd ...	Guernsey...	2521	6-3-29	13-1-33	273	14	4,467	5·8	264·84	Denmark Stud Farm	Rose Chief of Wollongbar
Clarendon Eyre Tangerine 2nd	Jersey ...	33952	24-4-29	23-11-32	273	20½	5,491	4·1	225·65	Sabina Vale Stud Farm	Clarendon Eyre Eminents Music M.
Glanavon Verna	A.I.S. ...	2369	6-4-29	25-10-32	240	19	5,370	4·1	222·33	D. Bevan & Sons ...	Pinecreek Dunbar
Banyule Silvermine 66th ...	Jersey ...	28847	10-9-29	3-6-33	90	34	3,090	...	151·11	Sabina Vale Stud Farm	Milkmaid's Chief of Banyale

COWS OVER 3 YEARS OLD AND UNDER 3 YEARS 6 MONTHS—STANDARD 270 LBS. BUTTER FAT.

Cookalabai Jewel	Guernsey	3,771	13-9-29	19-2-33	273	24	7,497	4·8	362·43	A. W. Padbury ...	Cookalabai Pride 2nd
Burnside Judy	Guernsey	2,540	5-5-29	29-10-32	273	14½	5,983	5·8	349·04	E. D. P. Hayes ...	Minnamurra Prairie Don
Springhurst Mellot 4th ...	Jersey ...	33,648	2-4-30	23-4-33	273	20½	6,451	5·3	344·61	Sabina Vale Stud Farm	Valiant Prince of Glen Iris
Springhurst Belladonna 4th ...	Jersey ...	33,644	12-2-30	13-4-33	273	16½	6,124	5·1	313·72	Sabina Vale Stud Farm	Starbright's Prince of Glen Iris
Berrington Soprano 2nd ...	Jersey ...	23,851	5-10-29	19-1-33	273	19½	5,263	5·9	311·66	Sabina Vale Stud Farm	Banyule Superstrain
Wollongbar Rosebud	Guernsey	2,783	10-1-30	14-2-33	273	16	6,243	4·9	298·39	Denmark Stud Farm	Wollonbar Satisfaction
Tipperary Priscilla	A.I.S. ...	2,359	9-9-29	1-3-33	273	23	7,044	4·09	286·41	R. Bee & Sons ...	Villiers of Darbalara
Claremont Bidly 13th	A.I.S. ...	2,392	18-12-29	7-1-33	173	22	6,951	4·1	286·31	Hospital for Insane	Claremont Evan
Grassvale Cream Goods ...	Jersey ...	34,814	23-8-29	15-10-32	273	13½	6,340	4·5	282·99	R. H. Rose	Choice Goods of Garden Hill
Tipperary Royal Lady	A.I.S. ...	2,377	13-11-28	22-10-32	273	9	6,072	4·3	260·56	R. Bee & Sons ...	Melba's Re-Echo of Tipperary
Spurfield Desdemona	Guernsey...	2,764	29-1-30	2-2-33	273	18	5,004	5·1	257·94	Denmark Stud Farm	Spurfield Eastern King
Wyuna Lady Dawn	Guernsey...	2,472	12-11-29	9-1-33	273	15	4,740	5·3	251·34	Denmark Stud Farm	Nundorah Prosper
Denmark Rosa 4th	Guernsey...	2,794	3-8-29	27-12-32	273	16	5,013	4·8	242·25	Denmark Stud Farm	Wollonbar Reformer
Melba 5th of Minni	A.I.S. ...	5,234	12-9-29	15-2-33	210	25	6,210	...	242·28	H. O. Timms ...	Barugh Dairyman
Wollongbar Haughty	Guernsey...	2,492	30-11-29	16-2-33	240	11½	3,535	...	178·35	Denmark Stud Farm	Wollongbar Hopeful

HERD TESTING—*continued.*

COWS OVER 2 YEARS 6 MONTHS OLD AND UNDER 3 YEARS OLD—STANDARD 250LBS. BUTTER FAT.

Name of Cow.	Breed.	Herd Book No.	Date of Birth.	Date of Calving.	No. of Days in Test.	Weight of Milk last day of Test.	Weight of Milk for period.	Average Test.	Butter Fat.	Owner.	Sire.
						lb.	lb.	%	lb.		
Claremont Whitby Maid 11th...	A.I.S. ...	...	2-6-30	1-5-33	273	36	10,398	3·9	398·38	Hospital for Insane	Claremont Elector
Nooka Lass	Jersey ...	28,187	14-1-29	25-12-32	273	23½	7,780	4·8	370·75	S. P. Herbert ...	Jessie's King of Sarnia
Claremont Poppy 3rd ...	A.I.S. ...	...	16-3-30	11-3-33	273	34½	9,178	4·0	367·05	Hospital for Insane	Claremont Elector
Grangelea Pretty Primrose ...	Jersey ...	33,038	31-10-29	23-10-32	273	22	6,171	5·9	364·13	Sabina Vale Stud Farm	Banyule Airo
Mokine Miss Fox	Jersey ...	...	24-11-29	11-10-32	273	18	5,589	5·0	277·88	T. H. Wilding ...	The Valley Twylish Fox
Juadine Julieth 6th	Jersey ...	34,344	20-10-29	10-10-32	273	15	4,680	5·8	272·99	Miss L. Hancock ...	Mokine Repulse
Denmark Rose Pearl 5th ...	Guernsey	3,281	20-8-30	2-3-33	273	15	4,245	5·4	229·90	Denmark Stud Farm	Reformer of Wollonglar
Mokine Empire Twylish ...	Jersey ...	...	30-12-29	13-10-32	273	13	4,569	5·1	226·62	T. H. Wilding ...	The Valley Twylish Fox
Mokine Columbine 6th ...	Jersey ...	...	15-2-30	10-10-32	273	18	4,734	4·7	223·81	T. H. Wilding ...	The Valley Twylish Fox
Colmyn Veronica Rye ...	Jersey ...	31,194	10-11-29	17-9-32	240	9	3,780	...	197·67	C. H. Ironmonger ...	Rye Duke of Glen Iris
Springmead Island Flower ...	Jersey ...	...	5-5-30	10-1-33	273	6½	3,154	4·6	143·68	Sabina Vale Stud Farm	Springmead Islander

COWS UNDER 2½ YEARS OLD—STANDARD 230 LBS. BUTTER FAT.

Koojan Bo-Peep	Guernsey...	3,542	26-2-31	18-4-33	273	23	6,759	5·77	390·15	A. W. Padbury ...	Homestead Ace
Widgee Waa Rosy 5th ...	A.I.S. ...	5,117	20-4-30	18-10-32	273	34	9,252	3·8	359·21	W. G. Burges ...	Parkview Mayflower Monarch
Claremont Cleggett 4th ...	A.I.S. ...	...	24-11-30	13-4-33	273	29	8,472	4·0	340·59	Hospital for Insane ...	Searchlight of Sunnyvale
Claremont Beanie 4th	A.I.S. ...	...	11-8-30	21-10-32	273	16	7,088	4·4	305·36	Hospital for Insane ...	Searchlight of Sunnyvale
Travalgan Lady Mint	Jersey ...	...	21-7-30	19-12-32	273	24	5,517	5·5	303 66	Robinson Bros. ...	Fern's Masterpiece of G.H.
Glanavon Penelope	A.I.S. ...	2,366	21-8-30	24-11-32	273	29	7,287	4·1	301·58	D. Bevan & Sons ...	Villiers of Darbalara
Koojan Dairymaid	Guernsey	3,543	13-2-31	22-2-33	273	8½	4,810	6·2	299·64	A. W. Padbury ...	Homestead Ace
Parkview Poppy 3rd	A.I.S. ...	4,135	20-9-30	20-1-33	273	21	7,338	4·0	293·94	W. G. Burges ...	Mayflower's Repeater of Hillview
Denmark Irish Lass	Guernsey	3,269	30-8-30	12-12 32	273	18	5,544	5·1	280·52	Denmark Stud Farm	Denmark Empire Chief
Grass Vale Cream Duchess 5th	Jersey ...	...	4-4-31	9-4-33	273	17	5,676	4·9	276·11	R. H. Rose	Campanules Duke of Burekup
Mokine Amy	Jersey ...	...	5-9-30	4-10-32	273	19	5,622	4·8	270·62	T. H. Wilding ...	Mokine Repulse
Wooroloo Jean	A.I.S. ...	5,221	15-7-30	9-11-32	273	15	6,405	4·2	269·95	Wooroloo Sanatorium Farm	Triumph of Pine Creek
Nooka Daisy	Jersey ...	...	27-3-31	7-11-32	273	14½	4,993	5·3	266·35	S. P. Herbert ...	Springpark Prince Ragtime
Moorlands Florrie	Jersey ...	...	10-6-31	23-3-33	273	12½	5,152	5·1	258·47	P. Rose	Melrose Sultan
Parkview Model	A.I.S. ...	...	20-10-30	28-11-32	273	23	6,614	3·9	255·79	W. G. Burgess ...	Joan's Monarch of Blacklands
Burnside Ladybird	Guernsey...	3,322	8-10-30	4-11-32	273	14	5,352	4·7	255·62	E. D. P. Hayes ...	Denmark Radiant Chief
Springmead Lady Rose ...	Jersey ...	...	26-7-30	14-12-32	273	24	5,802	4·4	255·51	Sabina Vale Stud Farm	Springmead Beaucaire
Moorlands Flower	Jersey ...	...	13-6-31	8-5 33	273	7	4,461	5·7	254·12	P. Rose	Melrose Clarion
Colmyn Nellie Rye	Jersey ...	34,754	8-7-30	8-10-32	273	9½	5,498	4·6	253·09	C. H. Ironmonger ...	Colmyn Captain Mac.
Moorlands Fiona	Jersey ...	...	16-9-31	18-5-33	273	10½	4,860	5·2	252·94	P. Rose	Melrose Sultan
Nooka May Queen	Jersey ...	...	3-5-31	4-11-32	273	16½	5,044	5·0	250·42	S. P. Herbert ...	Springpark Prince Ragtime
Widgee Waa Beauty 7th ...	A.I.S. ...	5,116	19-4-30	14-10-32	273	13	6,099	4·0	244·96	W. G. Burges ...	Parkview Mayflower's Monarch
Longridge Gentle	A.I.S. ...	5,106	6-1-31	10-5-33	273	16	5,838	4·2	241·71	R. Bee & Sons ...	Minathorpe Kitchener
Parkview Favourite 2nd ...	A.I.S. ...	4,127	6-4-31	27-10-32	273	21	6,093	3·9	238·74	W. G. Burges ...	Hillview Daphne's Defence
Denmark Rose Dame 2nd ...	Guernsey...	3,280	18-7-31	30-10-32	273	15	4,975	4·7	233·90	Denmark Stud Farm	Wollonglar Reformer
Colmyn Lady Rye	Jersey ...	34,753	13-8-30	10-10-32	273	11	4,453	5·1	227·55	C. H. Ironmonger ...	Rye Duke of Glen Iris
Muresk Poppy	Guernsey...	3,293	8-8-30	8-11-32	273	14½	3,808	5·9	224·58	Muresk College ...	Triumph of Wollonglar
Burnside Princess	Guernsey	3,324	1-8-30	25-10-32	273	17	4,806	4·5	216·91	E. D. P. Hayes ...	Denmark Radiant Chief
Travalgan Ice Cream	Jersey ...	...	6-2-31	27-12-32	273	13½	3,820	5·5	210·67	Robinson Bros. ...	Banyule Altitude
Mokine Sapphire	Jersey ...	...	30-9-30	20-10-32	273	17	4,461	4·7	210·07	T. H. Wilding ...	Mokine Ruby
Claremont Lupin 7th	A.I.S. ...	5,107	16-1 31	28-12-32	240	18	4,515	4·07	183·24	D. Bevan & Sons ...	Claremont Forrester
Colmyn Showgirl	Jersey ...	34,756	28-11 30	16-12-32	273	14	4,047	4·3	174·35	C. H. Ironmonger ...	Colmyn Captain Mac.

A BLOWER ELEVATOR ATTACHMENT TO THE CHAFFCUTTER.

Geo. L. Sutton,

Director of Agriculture.

For many years it has been quite usual to find a wide belt or slat elevator attached to chaffcutters for the purpose of elevating chaffed hay into a storage bin or room. More rarely has such an elevator been used for elevating chaffed greenstuff into a silo. The reason for this is that, for smooth working, these belt and slat or bucket elevators require to be driven from the top; it is not difficult to provide this drive when the distance between the driver pulley on the chaffcutter spindle and the driven pulley at the head of the elevator is comparatively short, but, with the greater distance between the chaffcutter and the top of the tub or tower silo, the difficulties are so much increased that the belt type has never been very popular with silage makers. Since the advent of the blower type of elevator they have been almost entirely superseded by this type for elevating greenstuff.

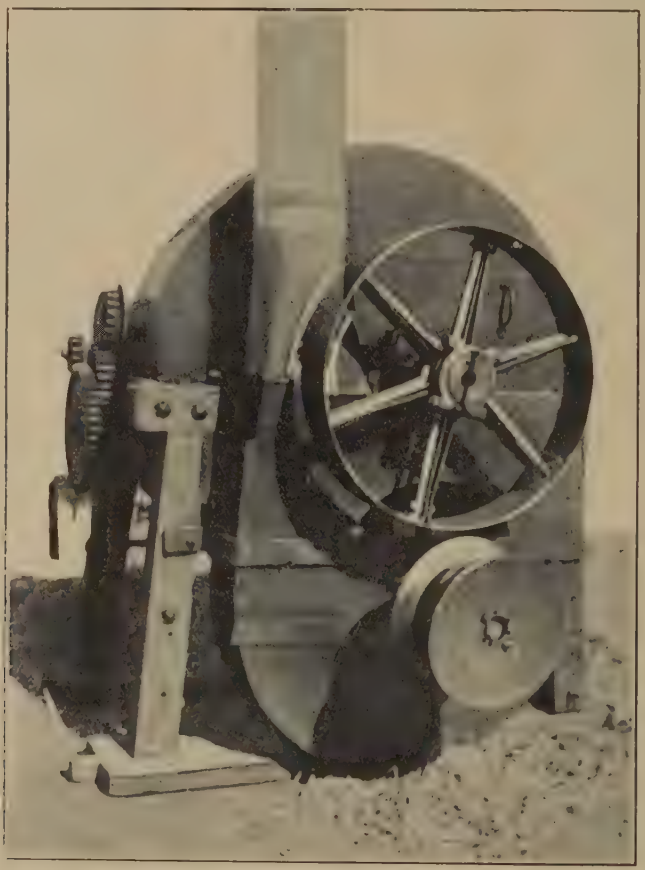
Such blowers have almost invariably been attached to American machines designed for cutting up thick-stemmed crops like maize, the principal silage crop of the United States of America, and for this purpose they are very suitable. These machines are, however, not well adapted for chaffing greenstuff of the thin-stemmed cereal type and not at all adapted for chaffing cereal and meadow hay, which is in continuous use the year round on West Australian farms.

The chaffcutter, on the other hand, is not only particularly suitable for chaffing hay, but it is also equally suitable for cutting up the cereal greenstuff from which silage in Western Australia is mainly made. Experience has also shown that the chaffcutter is quite suitable for cutting up green maize or sorghum for feeding direct to stock, or for the silo. The chaffcutter can therefore be used for both chaffing hay and greenstuff, and for West Australian conditions is more suitable and useful than the special silage cutter which can be used with advantage only for cutting up greenstuff.

To meet the requirements of the modern silage maker, the chaffcutter requires to have a blower elevator attachment. In the special silage cutters of the chaffcutter type the blower fan is fixed to the main spindle to which is also attached the cutting wheel. Such an arrangement is not possible with the West Australian chaffcutter, for the blower to lift the greenstuff the desired height—30 to 40 feet—has to be driven at such a high speed that the wheel of the chaffcutter, if run at that speed, would be driven at too great a speed for efficiency and safety; the chaffcutter wheel might even be driven into pieces. To obviate this in the special silage cutters the cutting wheels are specially strengthened, but this renders them much less suitable, if not entirely unsuitable, for chaffing hay. The difficulty of attaching a blower-elevator to the chaffcutter has, however, been overcome by attaching the blower fans to a spindle other than that to which the knife wheel is fixed. For dealing with chaffed hay Mr. H. Smith, a farmer in the Manmanning district, has had an attachment for the purpose on the market for some years.

As far as is known the first attachment to be used successfully for silage making was designed and made by Mr. R. D. Sims, "Waihopai," Highbury. An illustration of this appeared in "The Westralian Farmers' Gazette" of the 10th February, 1927, and which is reproduced in Fig. 1. This attachment has been

working successfully now for seven years, and not only is it used once yearly for filling the twin silos, 28 feet high, but it is used throughout the year for filling a chaff room with chaffed hay. For this latter purpose the chaff is elevated vertically 14 feet, and then blown horizontally 12 feet along the shed and through a home-made dust extractor. The blower is attached to a "Zealandia" chaffcutter with an 11-inch mouth and normally elevates 6 to 7 tons of chaffed



COMBINED CHAFF AND SILAGE CUTTER.
A "Zealandia" Chaffcutter with blower elevator attachment, made by Mr. R. W. Sims, "Waihopai," Highbury.

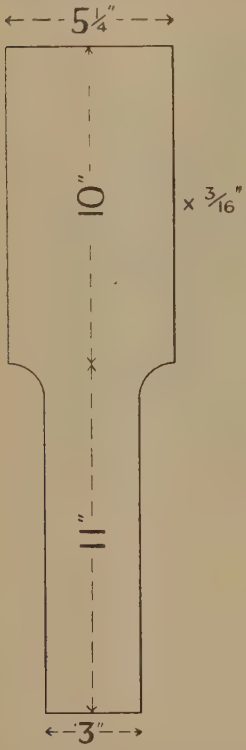
green material per hour, but its full capacity is greater, as 2 tons have been cut and elevated in 13 minutes. The blower was farm-made from harvester parts; the out-of-pocket expenses for these and for the 30 feet of 6-inch galvanised elevator piping and head-piece were £4 1s. 3d.

Stimulated by the need at the Avondale Stock Farm for a machine which could be used throughout the whole year for chaffing hay to meet the farm

requirements, and once a year for filling the 100-ton silo, and also encouraged by the achievement of Mr. Sims, it was decided to purchase a "State" chaff-cutter and attach a blower to it. This has been successfully done with the assistance of Messrs. H. J. Clucas, G. M. Dear and A. B. Mather, of the staff of the Perth Technical College, who designed and built the blower and casing, and attached same to the chaffcutter. The blower was designed for a speed of approximately 650 revolutions per minute.

The blower consists of six steel arms of T-cross section mounted in a cast-iron boss, and attached to a spindle 1½ inches in diameter; the over-all diameter of the arms is 3 feet. Secured to the end of the arms are the fan blades of sheet steel 3/16ths inch thick. The blades proper are machined to the following dimensions—width 5¼ inches, length 10 inches. Extending from the bottom of the blade is the shank by which the blade is riveted to the arm, this shank is 3 inches wide and 11 inches long.

The wheel as constructed was made from material that was available. Had it not been desirable to utilise this material, there is no doubt that the design could have been improved upon.



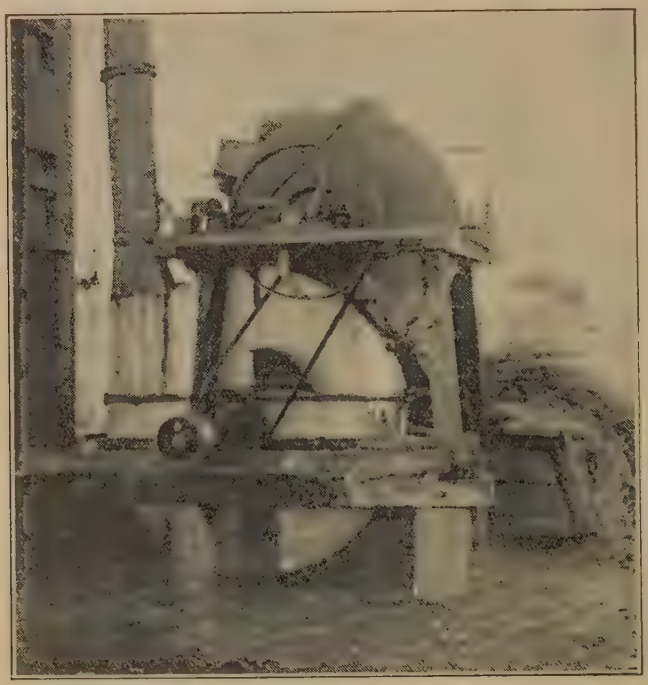
Sketch of Fan Blade.

The width of casing enclosing the fan is 6 inches wide with ½ inch clearance beyond the ends of the fans. In order to use some 8-inch galvanised piping for the elevator tube the outlet from the casing has been increased to accommodate this. The cut material from the chaff-cutter is fed into the blower casing by means of an apron, which directs the cut material from the bottom of the wheel to where it enters the fan casing at an opening just above the spindle. The air inlet is provided by another opening on the opposite side of the casing.

The heaviest duty required of the blower is to lift green cut cereals to the top of a silo 33 feet high; to perform this work, with the chaff-cutter being fed at full capacity and at about 300 revolutions per minute, the speed of this 4-feet blower requires to be not less than 630 revolutions per minute. With a fan of smaller diameter its speed and number of revolutions per minute would require to be greater, as is the case with the blower of Mr. Sims, with 800 to 850 revolutions per minute.

Trials at Avondale have shown the importance of driving the blower fast enough. With a speed of 520 revolutions per minute the blower choked almost immediately the greenstuff entered the casing. With a speed of 600 revolutions per minute the blower elevated the material, provided the chaffcutter was fed lightly, say, slightly more than half its capacity. With a speed of 630 revolutions per minute the material was elevated readily, even when the chaffcutter was fed to its full capacity of 6 to 7 tons of greenstuff per hour.

One of the drawbacks associated with this combination, which requires that the blower be driven separately, and not driven on the same spindle as the cutting wheel, is that the distance between the centres of the two spindles is necessarily very short. This involves the use of a short belt, and this is mechanically unsound as the gripping surface on the pulleys is relatively small; this defect is minimised by having the pulleys on the blower wheel spindles reasonably large. As the optimum speed of the blower is in the vicinity of 630 revolutions per minute, and that of the chaffcutter 300 to 350 revolutions per minute, the relative sizes of the pulleys required were as 1 : 2, the diameters of those used were 10 inches on the blower and 20 inches on the chaffcutter.



COMBINED CHAFF AND SILAGE CUTTER.

A "State" Chaffcutter with blower elevator attachment.

The trials at Avondale also demonstrated that, for smooth running, it is essential to drive the blower direct from the engine, with the chaffcutter driven by means of appropriate pulleys from the blower shaft. It was found that, when the chaffcutter was driven direct from the engine, and the blower from a pulley on the chaffcutter, the blower would slow down and choke when the feeding was a little heavier than usual.

The power used to drive the combination is an 8-horsepower Crossley oil engine. For cutting and elevating the green cereals with which the silo is filled it is barely powerful enough, and, in consequence, the cutter requires to be fed very carefully and regularly.

When the chaffcutter is used for chaffing green cereals, which have been cut with a reaper and binder, it is advisable, in order to lessen the possibility of the cutter choking, to feed the material into the rollers butts first rather than heads first, as is the practice when chaffing cereal hay.

The combination chaffcutter and blower has proved extremely satisfactory. Except for the care necessary in feeding the cutter the 33-feet silo has been filled without difficulty, and the green material has been chaffed more evenly than previously when the special type of silage cutter was used. Since the silo has been filled the combination has been used for filling a loft with chaffed cereal hay. When on this work the chaffed hay has to be blown vertically about 18 feet and horizontally the length of the shed, about 35 feet. It is doing this quite satisfactorily and apparently the engine is powerful enough for this work.

FRUIT FLY.

SEASON 1933/34.

GEO. W. WICKENS, Superintendent of Horticulture.

It is many years since the Fruit Fly pest has done as much damage as it has during the present season, and in searching for the cause of the increase in the number of flies I am convinced the principal factor has been a much greater carry-over through the winter—in the orange crop—than is usual, owing to mild weather conditions.

I am indebted to the Commonwealth Meteorologist, Mr. Curlewis, for particulars regarding temperatures in Perth, Kalamunda, Guildford, and Donnybrook, which show that in June, September, and November of 1933 the average for those months was considerably above normal, and in commenting thereon he states:—"Perth and fruit and dairying districts experienced warmer nights than usual for June. Except for one or two sharp spells the nights were remarkably warm and the average minimum temperature for the month was three to five degrees higher than the general average."

Anyone who is familiar with the manner in which fruit flies congregate in the orange orchards towards the end of autumn and early winter will readily understand what warm weather in June means in assisting the flies to use the fruit as a host. Under these conditions many fruits would, and did, successfully carry the eggs of the pest, and many of the over-wintering flies found the early spring weather conditions highly suitable for breeding purposes. On one day in that month—25th—Perth recorded 87deg., Guildford 89deg., Kalamunda 84deg., and Donnybrook 84deg. With oranges and loquats to provide facilities for egg laying at that period the resultant flies arriving on the scene in November found ideal conditions in a heavy crop of early peaches and apricots, and weather conditions again above normal.

The average maximum and minimum temperatures for November, and those obtaining in November, 1933, as supplied by Mr. Curlewis, show:—

Perth:

Average maximum for November	75.7deg.
Average minimum for November	56.8deg.
Average maximum, November, 1933	80.3deg.
Average minimum, November, 1933	59.0deg.

Guildford:	
Average maximum for November	79.3deg.
Average minimum for November	55.1deg.
Average maximum, November, 1933	85.3deg.
Average minimum, November, 1933	57.3deg.
Kalamunda:	
Average maximum for November	76.9deg.
Average minimum for November	54.9deg.
Average maximum, November, 1933	85.3deg.
Average minimum, November, 1933	57.3deg.
Donnybrook:	
Average maximum for November	75.8deg.
Average minimum for November	50.1deg.
Average maximum, November, 1933	79.5deg.
Average minimum, November, 1933	50.8deg.

I think in the above I have shown good reason why fruit flies are more numerous this season than usual, but there is no guarantee that similar weather conditions will not occur next season, and the only way to guard against serious losses is for all orange growers in infested areas to be vigilant in winter time as well as in summer.

Unfortunately, very few take the steps necessary to control fruit fly in the winter months; traps are seldom used, and fruit lies on the ground for a week or more at a time before it is picked up. As a result the pest carries through the winter to find a congenial breeding ground in early summer stone fruits and later —February, March, April—severely attacks Valencia oranges, finishing the season under ideal conditions for again carrying through the winter.

Readers are referred to the article by the Entomologist (Mr. Newman) appearing in this issue for formulae for use in the control of fruit fly by foliage baiting and trapping, and all fruit growers are earnestly urged to concentrate on exterminating the winter brood, for this cannot be achieved in summer when the pest has become a plague.

DENMARK WASTING DISEASE.

J. F. FILMER, B.V.Sc., Senior Veterinary Surgeon,
and
E. J. UNDERWOOD, Ph.D., B.Sc., Animal Nutrition Officer.

"Wasting Disease" is the name which has been coined for a disease which affects cattle and sheep in some parts of the Denmark district. It is characterised by progressive emaciation and anaemia followed by death, and by the fact that affected animals recover when transferred to sound locations. This disease was first brought under the notice of the Department of Agriculture in November, 1921, when only a few farmers were experiencing trouble. With the advent of Group Settlement and its attendant land development the problem assumed more serious proportions, until by 1928, some forty farms, comprising a total area of about five thousand acres, were known to be affected.

The unsound farms all contain a proportion of karri hill country and the disease appears to be associated with this type of land. It must, however, be emphasised that on many farms situated on karri slopes no trouble is experienced in rearing healthy calves.

The disease generally affects calves between the ages of six and eighteen months, though younger calves are sometimes affected and, during recent years especially, the disease has occurred amongst mature cattle. These latter have seldom been affected when they were receiving concentrates, the protective effect of bran being particularly noticeable in this regard. Unfortunately, concentrates do not appear to have any effect in preventing the disease in calves. Sheep, and especially lambs, are even more susceptible than calves, and two instances have been reported of their suffering from the disease where no trouble is experienced with calves.

The disease most commonly occurs during the spring and early summer, when there is an abundance of green feed, but it is not entirely confined to this time of the year.

Ofter the first symptom to be noted is depraved appetite, the calf manifesting a marked inclination to chew bark, sticks, bracken, bones, earth, etc., followed usually by a gradual decline in general appetite. The calves show little interest in pasture and then neglect it altogether, until finally they cannot be tempted to eat even such delicacies as crushed oats or bran. There is a falling off in condition, which may be quite rapid when loss of appetite has supervened. Diarrhoea is generally noted, particularly in young calves, and blood and slime is often seen in the dung.

The hair becomes long, the skin scurfy, and there is often redness and tenderness on the inside of the hind legs. The calves become weak, are easily exhausted, and finally are unable to stand. Death generally occurs in from six weeks to six months, though in mature cattle the disease may run a longer course.

When the disease was first reported in 1921, the Department was unable to spare officers to make thorough investigations. However, the problem was kept in mind and, from 1921 to 1928, veterinary officers made several visits to the district. The resemblance to "bush sickness" in New Zealand was early noted, but unfortunately the remedies which had been successfully used against that disease did not prove correspondingly effective in Denmark. In 1928 a series of experiments were conducted by the Department on an affected farm, and from 1928 to 1931 a number of settlers conducted experiments under the supervision of departmental officers. In addition, a large number of chemical analyses of pastures, soils, stock waters and blood were made during this period. Considerable attention was also devoted to a study of the pathology of the disease, including numerous post mortem and blood examinations. The result of this work was to confirm the opinion, which had long been held, that the disease was a form of malnutrition, due in all probability to some deficiency in the composition of the pasture.

However, as the chemical analyses had given no clue and the food supplements tried had proved ineffective, the Department decided to lease an affected farm from 1st June, 1931, and an extensive series of experiments was initiated on this holding under the direct control of the Department.

Lambs had been proved to be susceptible to the disease and their use would enable a much greater number of experiments to be conducted than would have been possible with calves, so they were chosen for the first year's experimental work. This policy has been abundantly justified, as it has been possible to confirm with calves all results which were achieved with lambs.

In the initial series of experiments 80 lambs were used and 12 different forms of treatment were tried. In all, 92 sheep and 48 calves have been used on the leased farm and the preventive and curative measures tried have been increased to 35. Amongst the supplements tried were compounds of iron, copper, manganese, iodine, phosphorus, lime, magnesium and arsenic; substances from sound holdings such as chaff, creek water, soil and jarrah ash; and such biological products as dried blood, meat meal, dried pig stomach, and various preparations of liver.

The first substance with which "Wasting Disease" in sheep was cured was a proprietary liver preparation known as "Heparadine," which was kindly donated by Heparadine Pty. Coy., Ltd. This was first used successfully in May and June, 1932. Later it was arranged for liver to be dried at the Government abattoirs and

Calf 36—Affected with Wasting Disease; weight, 30/9/33, 286 lbs.

Calf 36—After treatment with Limonite; weight, 19/12/33; 456 lbs.

this was successfully used in the treatment of affected sheep and cattle. Raw liver in quarter-pound doses given twice daily also cured affected heifers. But all efforts to obtain an effective liver preparation which was convenient and cheap met with failure.

Iron and ammonium citrate, which was the first remedy successfully used in the treatment of New Zealand "bush sickness," consistently failed to cure "wasting disease" when given in the doses recommended in New Zealand, though it sometimes appeared to cause temporary improvement. These doses prevented the development

Calf 17—Affected with Wasting Disease; weight, 28/6/33, 354 lbs.

Calf 17—After treatment with Limonite; weight, 16/11/33; 560 lbs.

of the disease in seven out of nine lambs and in three out of four calves on the experimental farm. The lambs, however, did not grow nearly as well as they should have done.

In September, 1932, the effect of a treble dose of this drug was tried and met with excellent results. This prompted a search for an iron compound which was cheap, palatable and harmless in large doses. It was finally decided to try an iron ore known as "limonite" which had replaced all other agents in the treatment of "bush sickness" in New Zealand. This was first used in November, 1932, when it was given in very large doses to a badly affected heifer. Recovery was rapid, and by February, 1934, the animal was completely cured. Limonite has now been responsible, on the experimental farm alone, for the recovery of 13 sheep and five calves. Since January, 1934, it has been administered to 21 cattle, 12 of which are under two years old. All have maintained excellent condition. In addition, it has been used by a number of settlers, all of whom have so far given favourable reports.

Limonite has been compounded into a lick and is being sold by Messrs. Cuming, Smith, Mount Lyell, Ltd., under the name of Denmark Lick No. 1. It has the following formula—

Limonite	100 parts
Copper sulphate	¼ part
Dicalcic Lick	40 parts
Linseed Meal	20 parts

The prices are £11 10s. per ton and 13s. 6d. per cwt., cash on rails Perth.

It is suggested that this lick be fed in the following doses:—No lick should be given to calves under one week; calves from one week to six months, ½ ounce twice daily; from six to 12 months, 1 ounce twice daily; over 12 months, 1½ ounces twice daily. All affected animals should be given the full dose of 1½ ounces twice daily irrespective of age. It is hoped that when animals have become thoroughly healthy, it may be possible to reduce the above doses considerably, but owners would be well advised to adhere to the recommended doses for at least six months after first using. The best method of giving this lick is mixed with the feed, and for cows it is most conveniently given at milking time. It is strongly recommended that special small bails be provided for calves and that special small bails be provided for calves and that they be fed in these twice daily.

For the sake of those who have not had much experience in rearing calves the following procedure, which has given excellent results on the experimental farm, is appended. Calf to run with the cow for 24 hours after birth, or it may be removed immediately. In any case it should receive the milk from its mother for at least four days. During the first week, give two quarts of whole milk twice daily and increase this to three quarts twice daily for the next three weeks. In the fifth week, give twice daily two quarts whole milk and one quart skim milk with ¼ pound pollard mixed in. This will accustom the calf to eating dry feed in the bail. In the sixth week, change to one quart of whole milk and two quarts of skim milk twice daily. The milk should now be followed by ¼ pound of crushed oats at each meal. From seven weeks to six months the calf should receive three quarts of skim milk followed by ½ pound crushed oats twice daily. After weaning, it is wise to continue the oats until the calf is 12 months old, when it may be gradually replaced by chaffed meadow hay. The lick should be given first in the milk, then in the oats and finally with the chaff. Do not put the lick out in the paddock for stock to take at will as this method is wasteful and does not ensure each animal obtaining its proper share. It is absolutely necessary to ensure that the full dose is eaten by each animal.

The Department will welcome reports concerning the results following the use of Denmark Lick No. 1, whether these be favourable or adverse.

FIELD EXPERIMENTS WITH WHEAT AND OATS, EXPERIMENT FARMS, 1933.

I. Thomas, Superintendent of Wheat Farms.

Although over the greater part of the wheat belt the total rainfall for the conventional growing period (May to October) was about equal to the average, the incidence of the precipitations was not altogether satisfactory.

Following upon the dry summer and autumn the seasonal winter rains did not commence until the beginning of the last week in May. This gave no opportunity for weed destruction prior to seeding some of the crops, and consequently many of those sown on a dry seed bed suffered considerably from weed competition.

Crops planted after the commencement of the rains suffered less in this direction and in most cases the results were more satisfactory.

The rainfall for May, June, July and August was above the average and in some districts trouble was experienced through waterlogging. During September and October a dry and rather anxious period was experienced. However, the crops withstood this better than might have been expected.

The experience of this season indicated that when weeds are likely to be troublesome it is desirable to wait for the rains before seeding. This may entail the planting of suitable early and very early maturing varieties and farmers would do well to retain a reserve supply of seed of a variety such as "Noongaar" wheat in anticipation of a late opening to the season.

The results of the experiments conducted at the Dampawah, Yilgarn, Merredin and Chapman experiment farms are given below. The results of the experiments at the Salmon Gums Experiment Farm and the Wongan Hills Light Lands Farm will appear in the June issue of this Journal.

With but one or two minor exceptions the experimental plots are all one-eighth of an acre in area (833 links by 15 links), replicated five times and each treatment compared with an adjacent control.

The superphosphate used throughout the experiments had a phosphoric acid content of 22 per cent.

DAMPAWAH EXPERIMENT FARM.

Farm Manager, F. A. Newman.

The monthly rainfalls as recorded at the farm during 1933, together with the average for the past six years, are set out hereunder:—

Year.	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sept.	Oct.	Total.			
1933	...	11	120	25	385	508	130	257	46	68	1,394	77	28	1,665
Average 5 years ...	13	49	67	44	215	270	157	162	55	61	920	83	56	1,232

The soil is a red friable loam originally carrying york gum, giant mallee, mulga and karara scrub. A three year rotation of fallow, wheat, and pasture is followed and all plots, except where otherwise stated, are planted on fallow.

The land on which the experiments were carried out was (unless the nature of the experiment required other treatment) ploughed during June and July, 1932, and was cultivated with a springtyne implement during September. All plots were planted with a combined cultivator drill.

The results of field experiments conducted during 1933 are tabulated below.

FALLOW AND NON-FALLOW EXPERIMENT.

Planted on 5th May, 1933. Variety—Gluyas Early. Seed—45 lbs. per acre. Superphosphate—90 lbs. per acre.

Treatment.	Computed Yields per Acre.			Average Yields per acre. 1933.	Percentage Yields. 1933.	Average Yields per acre. 1930-33.	Percentage Yields. 1930-33.
	Section 1.	Section 2.	Section 3.				
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%	bus. lbs.	%
Fallow	22 24	22 24	21 52	22 13	106	16 45	116
Non-Fallow	19 20	21 20	22 0	20 53	100	14 26	100

These results show that the yields of the wheat crop are increased when the land is fallowed.

TIME OF PLOUGHING EXPERIMENT.

Planted on 5th May, 1933. Variety—Gluyas Early. Seed—45 lbs. per acre. Superphosphate—90 lbs. per acre.

Time of Ploughing.	Computed Yields per Acre.					Average Yields per acre, 1933.	Percentage Yields, 1933.	Average Yields per acre, 1930-33.	Percentage Yields, 1930-33.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
June	22 16	24 24	23 54	24 8	24 56	23 55	100	16 58	100
August	19 28	23 36	20 48	23 52	22 0	21 57	92	15 54	94

The results for this year and the average results obtained over the four years that the experiment has been conducted indicate that the yields are increased when the land is ploughed during the early winter months. These are in conformity with similar experiments conducted at the other experiment farms.

DEPTH OF PLOUGHING EXPERIMENT.

Planted on 8th May, 1933. Variety—Gluyas Early. Seed—45 lbs. per acre. Superhposphate—90 lbs. per acre.

Depth of Ploughing.	Computed Yields per Acre.					Average Yields per acre, 1933.	Percentage Yields, 1933.	Average Yields per acre, 1930-33.	Percentage Yields, 1930-33.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
2 inches	24 40	21 36	23 44	20 40	22 48	22 42	93	15 20	94
4 inches	22 48	24 8	25 12	24 40	24 40	24 18	100	16 23	100
6 inches	23 4	22 40	24 32	20 40	25 28	23 17	96	16 7	98

The results for this year and also the average results obtained over the period of four years that the experiment has been conducted, indicate that it is most economical to plough to a depth of 4 inches.

MULCHING EXPERIMENT.

Planted on 8th May, 1933. Variety—Gluyas Early. Seed—45 lbs. per acre. Superphosphate—90 lbs. per acre.

Treatment.	Computed Yields per Acre.					Average Yields per acre, 1933.	Percentage Yields, 1933.	Average Yields per acre, 1929–33. *	Percentage Yields, 1929–33. *
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
Cultivated before Seeding only	24 0	22 8	22 48	22 16	21 44	22 35	103	19 1	101
Cultivated in spring and before seeding ...	22 24	19 44	23 4	22 0	22 24	21 55	100	18 50	100
Cultivated in spring, during summer after †rain, and before seeding	21 52	23 44	21 44	22 0	20 8	21 54	100	18 19	97

* No results for 1931.

† This plot received four additional cultivations during the late spring and summer months.

These results do not indicate that any advantage is derived from cultivating fallow during the spring or summer months at this farm. Lack of response to the spring cultivations may possibly be due to the friable nature of the soil and the absence of weed growth.

TIME OF SEEDING EXPERIMENT.

Variety—Gluyas Early. Superphosphate—90 lbs. per acre. Seed—45 lbs. per acre.

Planted.	Computed Yields per Acre.					Average Yields per acre, 1933.	Percentage Yields, 1933.	Average Yields per acre, 1932–33.	Percentage Yields, 1932–33.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
18th April	20 48	19 44	20 16	18 56	21 4	20 9	95	16 57	95
16th May	20 56	21 12	23 28	20 32	20 8	21 15	100	17 50	100
17th June	13 28	13 12	13 52	13 52	13 28	13 34	64	10 34	59

As the winter rains did not commence until late in May, those plots sown in April germinated at the same time as those sown in May.

TIME OF SEEDING EXPERIMENT.

Variety—Noongaar. Superphosphate—90 lbs. per acre. Seed—45 lbs. per acre.

Planted.	Computed Yields per Acre.					Average Yields per acre, 1933.	Percentage Yields, 1933.	Average Yields per acre, 1931-32.	Percentage Yields, 1932-33.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
16th June	16 40	19 12	19 4	19 36	20 8	18 56	106	17 37	92
18th May	18 24	18 0	18 16	16 56	18 0	17 56	100	19 3	100
15th July	8 16	8 48	9 36	10 16	8 32	9 6	51	5 30	29

Both this year's results and the average results obtained over the two years that the experiment has been conducted, indicate that it is unwise to plant an early maturing variety after the end of May. The average results also indicate that, even when a very early maturing variety is planted, it is not a safe procedure to extend the planting period too far into June.

RATE OF SEEDING EXPERIMENT.

Planted on 28th April, 1933. Variety—Bencubbin. Superphosphate—90 lbs. per acre.

Rate of Seed per Acre.	Computed Yields per Acre.					Average Yields per acre, 1933.	Percentage Yields, 1933.	Average Yields per acre, 1929-33.	Percentage Yields, 1929-33.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
30 lbs.	25 20	25 4	22 48	20 8	21 4	22 53	101	13 14	104
45 lbs.	25 20	24 0	22 16	18 56	22 48	22 38	100	12 43	100
60 lbs.	23 20	21 44	20 40	21 4	20 48	21 31	95	12 4	95

RATE OF SEEDING EXPERIMENT.

Planted on 19th May, 1933. Variety—Noongaar. Superphosphate—90 lbs. per acre.

Rate of Seed per Acre.	Computed Yields per Acre.					Average Yields per acre 1933.	Percentage Yields, 1933.	Average Yields per acre, 1931-33.	Percentage Yields, 1931-33.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
30 lbs	16 8	19 4	21 36	19 36	20 24	19 22	94	16 18	97
45 lbs.	17 4	21 12	22 16	20 8	21 52	20 30	100	16 46	100
60 lbs.	18 32	20 32	22 16	20 16	23 36	21 2	103	16 58	102

The results indicate that little or no advantage is obtained by sowing a mid-season, tree-stooling variety at a rate in excess of 30 lbs. per acre or an early, sparse-stooling variety in excess of 45 lbs. per acre.

RATE OF APPLICATION OF SUPERPHOSPHATE EXPERIMENT.
(No. 1.)

Planted on 9th May, 1932. Variety—Gluyas Early. Seed—45 lbs. per acre.

Rate of Application of Superphosphate per Acre.	Computed Yields per Acre.					Average Yields per acre, 1933.	Percentage Yields, 1933.	Average Yields per acre, 1929-33. *	Percentage Yields, 1929-33. *
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
225 lbs.	22 48	21 28	19 36	18 24	18 56	20 14	104	17 0	100
150 lbs.	20 32	19 44	18 56	18 48	19 12	19 26	100	16 56	100
300 lbs.	22 16	21 4	20 0	19 36	19 44	20 32	106	17 25	103

*1930 results discarded.

RATE OF APPLICATION OF SUPERPHOSPHATE EXPERIMENT.
(No. 2.)

Planted on 9th May, 1933. Variety—Gluyas Early. Seed—45 lbs. per acre.

Rate of Application of Superphosphate per Acre.	Computed Yields per Acre.					Average Yields per acre, 1933.	Percentage Yields, 1933.	Average Yields per acre, 1929-33. *	Percentage Yields, 1929-33. *
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
Nil	11 52	12 56	14 40	13 12	14 24	13 25	68	8 25	49
150 lbs.	19 12	20 0	20 16	19 28	19 52	19 46	100	17 21	100
75 lbs.	17 20	17 52	18 40	17 12	17 12	17 39	89	15 50	91

* 1930 results discarded.

The average results indicate that no advantage is derived from applying superphosphate at rates in excess of 150 lbs. per acre. With wheat at its present prices to optimum quantity to apply would appear to be somewhat above 75 lbs. per acre and would probably be in the vicinity of 100 lbs.

SEASONAL PLANTING EXPERIMENT.

April Planting.

Planted on 18th April, 1933. Suerphosphate—90 lbs. per acre Seed—45 lbs. per acre.

Variety.	Maturity.	Computed Yields per Acre.										Average Yield per acre, 1933.		Percentage Yields, 1933.	Percentage Yields, 1931–33.
		Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.					
		bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	%	%
Bencubbin ...	Midseason ...	21	52	19	28	17	36	21	52	16	40	19	30	106	98
Gluyas Early	Early ...	20	40	18	24	16	40	20	24	16	0	18	26	100	100
Totadgin ...	Early ...	20	56	18	48	16	48	18	56	16	16	18	21	100	100*
Nabawa ...	Midseason ...	18	8	16	0	14	8	17	12	13	20	15	46	80	78
Gluyas Early	Early ...	21	4	20	0	17	52	21	44	18	0	19	44	100	100
Merredin ...	Early ...	21	36	19	28	18	56	20	8	18	40	19	46	100	97
Carrabin ...	Early ...	18	24	17	36	16	8	15	52	15	36	16	43	84	90
Gluyas Early	Early ...	20	56	19	36	20	8	21	36	17	44	20	0	100	100
Noongaar ...	Very Early ...	18	32	14	48	17	12	16	40	14	16	16	18	81	98

* 1932–33.

As the winter rains did not commence until late in May, those plots sown in mid-April germinated at the same time as those sown in mid-May.

SEASONAL PLANTING EXPERIMENT.

May Planting.

Planted on 18th May, 1933. Superphosphate—90 lbs. per acre. Seed—45 lbs. per acre.

Variety.	Maturity.	Computed Yields per Acre.										Average Yield per acre, 1933.		Percentage Yields, 1933.	Percentage. Yields, 1931–33
		Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.					
		bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	%	%
Geeralying ...	Very Early ...	9	36	12	0	15	20	16	0	13	36	13	18	65	67
Gluyas Early	Early ...	19	12	22	0	21	44	20	0	19	44	20	32	100	100
S.H.J. ...	Early ...	13	28	15	4	16	56	15	28	15	4	15	12	74	70
Bencubbin ...	Midseason ...	21	44	24	0	21	20	23	20	23	28	22	46	113	106
Gluyas Early	Early ...	19	28	20	48	19	36	20	56	20	16	20	13	100	100
Nabawa ...	Midseason ...	21	36	20	32	18	32	20	16	18	48	19	57	99	86
Totadgin ...	Early ...	22	16	21	12	19	52	20	0	18	40	20	24	100	98*
Gluyas Early	Early ...	22	8	20	24	19	4	21	36	19	4	20	27	100	100
Carrabin ...	Early ...	18	56	16	56	16	0	17	20	18	0	17	26	85	87
Merredin ...	Early ...	23	4	22	24	20	56	21	20	23	28	22	14	114	100
Gluyas Early	Early ...	20	16	19	12	18	32	21	12	18	24	19	31	100	100
Noongaar ...	Very Early ...	14	32	14	16	16	40	17	44	18	0	16	14	83	87

* 1932–33.

SEASONAL PLANTING EXPERIMENT.

June Planting.

Planted on 16th June, 1933. Superphosphate—90 lbs. per acre. Seed—45 lbs. per acre.

Variety.	Maturity.	Computed Yields per Acre.										Average Yield per acre, 1933.		Percentage Yields, 1933.	Percentage Yields, 1931–33.
		Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.					
		bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	%	%
Geeralying ...	Very Early ...	14	0	14	48	14	24	13	12	15	36	14	24	94	94
Gluyas Early	Early ...	15	20	15	44	15	12	15	28	15	12	15	23	100	100
S.H.J. ...	Early ...	15	44	18	0	15	52	18	0	15	28	16	37	108	101
Merredin ...	Early	17	44	16	24	16	48	14	40	15	28	16	13	100	93
Gluyas Early	Early	16	24	16	16	15	44	14	48	17	44	16	11	100	100
Noongaar ...	Very Early ...	17	44	18	0	17	44	17	44	18	56	18	2	111	115

POTASH-NITROGEN EXPERIMENT.

Planted on 26th May, 1933. Variety—Gluyas Early. Seed—45 lbs. per acre.

Rate of Application Fertiliser per Acre.	Computed Yields per Acre.					Average Yields per acre, 1933.	Percentage Yields, 1933.	Average Yields per acre, 1932–33.	Percentage Yields, 1932–33.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
112lbs Sulphate of Ammonia 112lbs. Superphosphate	20 16	19 28	19 44	20 24	19 36	19 54	105	19 25	103
112lbs. Superphosphate	19 28	19 4	18 32	19 52	17 44	18 56	100	18 48	100
112lbs. Sulphate of Ammonia 56lbs. Muriate of Potash 112lbs. Superphosphate	17 12	18 56	18 16	19 52	20 0	18 51	100	19 18	103

These results indicate only a small increase in yield resulting from the application of sulphate of ammonia. This increase is insufficient to cover the cost of the fertiliser.

YILGARN EXPERIMENT FARM.

Farm Manager, R. W. Prünster.

The monthly rainfalls, as recorded at the farm during 1933, together with the average for the past six years are set out hereunder:—

Year.	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sept.	Oct.	Total.			
1933	20	...	108	39	211	245	120	193	40	50	859	42	70	1,138
Average 6 years ...	35	57	58	77	202	153	110	146	46	59	716	71	57	1,071

The season opened very late, the seasonal winter rains commencing on 21st May. For the first four months of the growing period, falls of above the average were recorded, but for September and October conditions were very dry, although the crops withstood this trying period better than would have been expected.

The land on which the experiments were conducted originally carried salmon gum and odd gimlet timber. It was ploughed with a disc cultivating plough during June and July of the previous year. Late in September it was springtyne cultivated Sheep were depastured on the fallowed land when necessary to assist in controlling weed growth. Immediately prior to planting the land was again springtyne cultivated.

The results of the field experiments conducted during 1933 are tabulated below:—

DEPTH OF PLOUGHING EXPERIMENT.

Planted on 19th May, 1933. Variety—Gluyas Early. Superphosphate—112 lbs. per acre.
Seed—30 lbs. per acre.

Depth of Ploughing.	Computed Yields per Acre.					Average Yields per acre. 1933.	Percentage Yields, 1933.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.		
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%
2 inches	17 44	15 12	16 40	16 8	14 24	16 2	98
4 inches	17 52	16 48	16 48	14 32	15 44	16 21	100
6 inches	17 12	17 12	14 48	15 20	14 24	15 47	97

Being for one year only, these results cannot be taken as conclusive. The 4-inch ploughing is certainly more economical than the 6-inch. The disadvantages of too shallow a ploughing such as to a depth of 2 inches include the difficulty of maintaining a suitable mulch and also procuring the desired seed-bed on which the seed is subsequently planted.

MULCHING EXPERIMENT.

Planted on 19th May, 1933. Variety—Gluyas Early. Superphosphate—112 lbs. per acre. Seed—30 lbs. per acre.

Treatment.	Computed Yields per Acre.					Average Yields per acre. 1933.	Percentage Yields. 1933.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.		
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%
Cultivated before seeding only	15 20	14 48	15 52	17 4	18 24	16 18	97
Cultivated in spring and before seeding	15 4	14 48	17 28	18 0	18 16	16 43	100
Cultivated in spring, during summer after rain and before seeding	15 44	15 28	17 4	18 24	17 52	16 54	101

These results, being for one year only, cannot be taken as conclusive.

The results of many years' experiments, similar to this but conducted at the Merredin Experiment Farm, indicate that the general practice should be to cultivate the fallow during spring and again prior to seeding, and, where the ground is weedy, this cultivation should be supplemented by additional cultivations after rain during the summer months.

TIME OF SEEDING EXPERIMENT.

Variety—Nabawa. Superphosphate—112 lbs. per acre. Seed—30 lbs. per acre.

Planted.	Computed Yields per Acre.					Average Yields per acre, 1933.	Percentage Yields, 1933.	Average Yields per acre, 1928-33.	Percentage Yields, 1928-33.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
18th April	18 24	20 32	20 24	24 48	25 36	21 57	95	19 15	101
16th May	20 32	20 48	22 8	26 8	26 16	23 11	100	19 5	100
21st June	9 4	9 20	10 40	8 48	9 52	9 33	41	10 23	54

TIME OF SEEDING EXPERIMENT.

Variety—Gluyas Early. Superphosphate—112 lbs. per acre. Seed—30 lbs. per acre.

Planted.	Computed Yields per Acre.					Average Yields per acre, 1933.	Percentage Yields, 1933.	Average Yields per acre, 1928-33.	Percentage Yields, 1928-33.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
21st June	14 16	14 40	13 52	12 40	13 36	13 51	56	12 27	67
16th May	24 0	24 48	25 12	24 56	23 52	24 34	100	18 41	100
15th July	7 4	5 44	5 20	5 28	6 32	6 2	25	6 37	35

Both this year's results and the average results obtained over the six years that the experiment has been conducted show that it is inadvisable to extend the planting period into the month of June. As indicated in the results it is better to plant a suitable mid-season maturing variety such as Nabawa or Bencubbin during the month of April than to plant other wheat varieties after the end of May.

RATE OF SEEDING EXPERIMENT.

Planted on 23rd May, 1933. Variety—Noongaar. Superphosphate—112 lbs. per acre.

Rate of Seed per Acre.	Computed Yields per Acre.					Average Yields per acre, 1933.	Percentage Yields, 1933.	Average Yields per acre, 1931-33.	Percentage Yields. 1928-33.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
20 lbs.	18 8	19 52	21 28	21 28	20 0	20 11	89	14 18	86
40 lbs.	20 8	23 36	24 8	22 32	22 24	22 34	100	16 40	100
30 lbs.	19 36	22 32	22 24	22 40	20 56	21 38	96	15 58	96

RATE OF SEEDING EXPERIMENT.

Planted on 18th April, 1933. Variety—Nabawa. Superphosphate—112 lbs. per acre.

Rate of Seed per Acre.	Computed Yields per Acre.					Average Yields per acre, 1933.	Percentage Yields, 1933.	Average Yields per acre, 1931-33.	Percentage Yields, 1931-33.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
20 lbs....	18 8	16 0	15 52	15 4	11 12	15 15	84	15 3	85
30 lbs.	19 52	19 44	18 32	17 44	14 32	18 5	100	17 40	100
30 lbs.	19 20	18 24	17 36	15 32	14 0	16 46	93	17 6	97

Both this year's results and the average results with both the free and the sparse-stooling varieties indicate that the rate of 20 lbs. per acre is insufficient and that the rate of 40 lbs. per acre shows to slight advantage against the rate of 30 lbs. per acre.

RATE OF APPLICATION OF SUPERPHOSPHATE EXPERIMENT.

Planted on 18th May, 1933. Variety—Gluyas Early. Seed—30 lbs. per acre.

Rate of Application of Superphosphate per Acre.	Computed Yields per Acre.					Average Yields per acre, 1933.	Percentage Yields. 1933.	Average Yields per acre, 1919-33	Percentage Yields. 1919-33
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
Nil	15 52	14 40	14 24	12 56	12 32	14 5	61	11 54	64
150 lbs.	24 16	24 24	22 0	22 24	21 44	22 58	100	18 42	100
75 lbs.	20 56	20 48	18 48	18 40	18 48	19 36	85	16 10	86

RATE OF APPLICATION OF SUPERPHOSPHATE EXPERIMENT.

Planted on 18th May. (No. 2.) Seed—30 lbs. per acre.

Variety—Gluyas Early.

Rate of Application of Superphosphate per Acre.	Computed Yields per Acre.					Average Yields per acre, 1933.	Percentage Yields, 1933.	Average Yields per acre, 1919–33*	Percentage Yields, 1919–33*
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
225 lbs.	22 48	22 40	23 28	23 44	23 12	23 10	105	17 13	100
150 lbs.	20 32	22 0	23 4	22 48	22 0	22 5	100	17 10	100
300 lbs.	23 36	24 24	24 8	24 8	24 8	24 5	109	17 22	101

*1932 results discarded.

These results again show that increased yields are obtained when superphosphate is applied up to 150 lbs. per acre.

Under present economic conditions the most economical rate of application appears to be between 100 and 112 lbs. per acre.

SEASONAL PLANTING EXPERIMENT.

Planted on 13th April, 1933. April Planting. Superphosphate—112 lbs. per acre.
Seed—30 lbs. per acre.

Variety.	Maturity.	Computed Yields per Acre.					Average Yields per acre, 1933.	Percentage Yields, 1933.	Percentage Yields, 1932–33.
		Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.			
		bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.		
Noongaar ...	Very Early ...	18 32	18 48	19 12	18 56	19 28	18 59	88	68
Gluyas Early	Early	20 56	21 28	22 8	21 52	21 44	21 38	100	100
Totadgin ...	Early	22 8	22 48	22 48	22 16	22 40	22 32	104	106
Bencubbin ...	Midseason ...	22 0	23 36	23 52	23 12	23 20	23 12	107	107
Gluyas Early	Early	20 48	22 8	21 20	22 32	22 40	21 54	100	100
Nabawa ...	Midseason ...	20 24	21 44	20 24	21 4	22 8	21 9	98	102

SEASONAL PLANTING EXPERIMENT.

Planted on 16th May, 1933. May planting. Superphosphate—112 lbs. per acre.
Seed—30 lbs. per acre.

Variety.	Maturity.	Computed Yields per Acre.					Average Yields per acre, 1933.	Percentage Yields, 1933.	Percentage Yields, 1932–33.
		Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.			
		bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.		
Noongaar ...	Very Early ...	21 20	19 44	19 12	20 16	20 0	20 6	94	70
Gluyas Early	Early	23 4	20 40	20 56	21 20	21 20	21 28	100	100
Geeralying ...	Very Early ...	22 0	20 16	20 48	18 56	19 44	20 21	95	85
Merredin	Early	22 48	21 44	22 16	20 0	20 48	21 31	104	96
Gluyas Early	Early	21 4	20 8	21 52	19 12	20 56	20 38	100	100
Totadgin ...	Early	21 52	22 0	22 8	20 40	22 0	21 44	105	108
S.H.J. ...	Early	21 20	19 12	18 24	17 12	19 36	19 9	92	91
Gluyas Early	Early	23 4	19 44	19 44	19 36	21 36	20 45	100	100
Carrabin ...	Early	21 4	18 56	18 8	18 32	20 0	19 20	93	97
Bencubbin ...	Midseason ...	24 40	21 52	20 48	23 4	23 44	22 50	110	113
Gluyas Early	Early	21 44	19 52	19 44	20 40	21 28	20 42	100	100
Nabawa ...	Midseason ...	21 20	20 24	20 56	21 44	22 8	21 18	103	101

SEASONAL PLANTING EXPERIMENT.

Planted on 20th and 21st June, 1933. June Planting. Superphosphate—112 lbs. per acre.
Seed—30 lbs. per acre.

Variety.	Maturity.	Computed Yields per Acre.					Average Yields per acre, 1933.	Percentage Yields, 1933.	Percentage Yields, 1932–33.
		Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.			
		bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.		
Noongaar ...	Very Early ...	14 40	11 52	10 40	12 40	9 44	11 55	108	109
Gluyas Early	Early	10 56	10 56	10 56	11 28	11 4	11 4	100	100
Geeralying ...	Very Early ...	10 24	9 12	8 40	10 24	10 0	9 44	88	90
Merredin ...	Early	10 56	9 4	9 44	11 44	11 12	10 32		101
Gluyas Early	Early	12 16	10 16	10 16	12 16	11 12	11 15	100	100
Totadgin ...	Early	12 40	10 40	11 36	12 16	12 16	11 54	106	111
S.H.J. ...	Early	11 20	9 44	8 24	9 4	10 8	9 44	83	87
Gluyas Early	Early	11 56	11 52	10 48	10 40	12 8	11 41	100	100
Carrabin ...	Early	12 24	9 44	9 36	10 24	10 56	10 37	91	93
Bencubbin ...	Midseason ...	13 4	13 20	13 4	13 4	14 8	13 20	110	116
Gluyas Early	Early	12 8	12 24	12 16	11 52	11 52	12 6	100	100
Nabawa ...	Midseason ...	10 8	10 32	10 8	11 4	13 28	11 4	91	105

It will be noted that the yields from the June planted plots are well below those from the plots planted during April and May, which indicates the inadvisability of extending the planting period into the month of June.

The germination of the April planted plots was delayed by the lack of early seeding rains and did not take place until after the rains which fell during the early portion of the last week in May, and which also germinated the May planted plots. Consequently the April plots lose their value of comparison with the May plots.

Previous years' experiments have demonstrated the advisability of commencing wheat seeding operations with a mid-season maturing variety such as Bencubbin or Nabawa planted in April. The major portion of the crop should be planted during the first three weeks in May, the main seeding month, with an early maturing variety such as Gluyas Early or Totadgin. Finally, the seeding operations should be completed during the last week of May with the proved early variety of "Noongaar."

POTASH-NITROGEN EXPERIMENT.

Planted on 17th May, 1933. Variety—Gluyas Early. Superphosphate—112 lbs. per acre. Seed—30 lbs. per acre.

Rate of application of Fertiliser per acre.	Computed Yields per Acre.					Average Yields per acre. 1933.	Percentage Yields, 1933.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.		
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	
112 lbs. Sulphate of Ammonia; 112 lbs. Superphosphate	19 20	19 4	18 32	19 12	19 52	19 12	97
112 lbs. Superphosphate ...	18 32	19 12	*	19 44	21 20	19 42	100
112 lbs. Sulphate of Ammonia; 56 lbs. Muriate of Potash; 112 lbs. Superphosphate	18 40	18 56	18 24	19 20	20 24	19 9	97

* Discarded owing to an accident in harvesting.

These results are for one year only and therefore not conclusive. They, however, indicate that the wheat yield at this farm is not increased through the application of either a nitrogenous or a potassic fertiliser.

MERREDIN EXPERIMENT FARM.

Farm Manager, J. H. Langfield.

The following table shows the monthly rainfall as recorded at the farm during the year together with the average over a period of 22 years.

Year.	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sept.	Oct.	Total.			
1933 ...	24	...	14	16	160	213	128	149	49	85	784	42	87	967
Av. 22 years	51	52	112	79	137	185	187	152	88	85	834	43	54	1,225

The rainfall from 1st January to 30th April was only 54 points, and although 160 points were registered for May, no rain of any consequence fell until the beginning of the last week of that month. Also, the rainfall for the growing period was 50 points below the average.

The land on which the experiments were conducted originally carried salmon gum and gimlet timber. It was ploughed during June, 1932, with a disc

cultivating plough, reploughed in September, cultivated with a tandem disc cultivator in early October and again cultivated with the disc cultivating plough during November. The continual use of these disc implements was necessary owing to the difficulty of dealing with the strong weed growth.

All plots were springtyne cultivated prior to seeding, and, where necessary owing to later planting, this cultivation was repeated.

The results of field experiments conducted during 1933 are tabulated below:—

FALLOW AND NON-FALLOW EXPERIMENT.

Planted on 14th June, 1933. Variety—Totadgin. Superphosphate—112 lbs. per acre. Seed—40 lbs. per acre.

Treatment.	Average Yields per acre, 1933.	Percentage Yields, 1933.	Average Yields per acre, 1925-33.	Percentage Yield, 1925-33.
	bus. lbs.		bus. lbs.	
Fallowed	30 40	196	24 38	142
Unfallowed	15 40	100	17 18	100

These results show definitely that decreased yields can be expected when the land has not been fallowed.

TIME FOR PLOUGHING EXPERIMENT.

Planted on 1st June, 1933. Variety—Totadgin. Superphosphate—112 lbs. per acre. Seed—40 lbs. per acre.

Time of Ploughing.	Average Yields per acre, 1933.	Percentage Yields, 1933.	Average Yields per acre, 1930-33.	Percentage Yields, 1930-33.
	bus. lbs.		bus. lbs.	
June	30 48	100	30 33	100
July	28 8	91	26 56	88
August	24 0	78	20 59	69

These results emphasise the advantage of early fallow.

MULCHING EXPERIMENT.

Planted on 31st May, 1933. Variety—Totadgin. Superphosphate—12 lbs. per acre. Seed—40 lbs. per acre.

Treatment.	Computed Yields per Acre.					Average Yields per acre, 1933.	Percentage Yields, 1933.	Average Yields per acre, 1915-33*	Percentage Yields, 1915-33*
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.		bus. lbs.	
Cultivated in spring, during summer after rain, and before seeding	18 16	20 0	20 32	21 12	23 52	20 46	98	21 48	101
Cultivated in spring, and before seeding	16 48	20 16	21 28	22 8	25 36	21 15	100	21 34	100
Cultivated before seeding only	15 28	18 48	18 48	19 4	25 28	19 31	92	20 21	94

* Exclusive of 1931.

The average results obtained over a period, extending back to 1915, indicate that the general practice should be to cultivate the fallow during spring and again prior to seeding, and where the ground is weedy, this cultivation should be supplemented by additional cultivations after rain during the summer months.

RATE OF SEEDING EXPERIMENT.

Planted on 29th May, 1933. Variety—Nabawa. Superphosphate—112 lbs. per acre.

Rate of Seed per Acre.	Computed Yields per Acre.					Average Yields per acre, 1933.	Percentage Yields, 1933.	Average Yields per acre, 1913-33*.	Percentage Yields, 1913-33*.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.		bus. lbs.	
30 lbs.	26 8	24 16	25 36	25 38	25 20	25 22	100	19 31	95
45 lbs.	23 4	26 24	25 12	23 28	28 0	25 14	100	20 31	100
60 lbs.	22 56	25 4	26 24	23 20	28 16	25 12	100	20 35	100

* Excluding 1914.

RATE OF SEEDING EXPERIMENT.

Planted on 8th June, 1933. Variety—Noongaar. Superphosphate—112 lbs. per acre.

Rate of Seed per Acre.	Computed Yields per Acre.					Average Yields per acre, 1933.	Percentage Yields, 1933.	Average Yields per acre, 1913-33*.	Percentage Yields, 1913-33.*
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.		bus. lbs.	
30 lbs.	28 0	26 16	27 12	26 56	26 8	26 54	92	18 56	96
45 lbs.	29 44	27 12	29 36	29 4	29 44	29 4	100	19 42	100
60 lbs.	28 32	28 24	31 12	30 24	32 32	30 13	104	19 26	99

* Excluding 1914.

The average results indicate that in this district it is unnecessary to sow either the sparse or the free-stooling varieties at a rate greater than 45 lbs. per acre.

TIME OF PLANTING EXPERIMENT.

Variety—Nabawa. Superphosphate—112 lbs. per acre. Seed—40 lbs. per acre.

Planted.	Computed Yields per Acre.					Average Yields per acre, 1933.	Percentage Yields, 1933.	Average Yields per acre, 1929-33.	Percentage Yields 1929-33.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.		bus. lbs.	
Mid April ...	30 8	31 4	32 0	32 16	33 4	31 42	118	24 26	102
Mid May	26 48	26 8	27 12	25 44	28 32	26 53	100	23 59	100
Mid June ...	25 12	27 12	27 12	26 24	26 24	26 29	99	19 43	82

TIME OF PLANTING EXPERIMENT.

Variety—Gluyas Early. Superphosphate—112 lbs. per acre. Seed—40 lbs. per acre.

Planted.	Computed Yields per Acre.					Average Yields per acre, 1933.	Percentage Yields, 1933.	Average Yields per acre, 1929-33.	Percentage Yields 1929-33.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.		bus. lbs.	
Mid June ...	24 0	27 12	25 28	26 56	24 0	25 31	137	22 17	90
Mid May	19 36	18 48	21 4	16 48	16 56	18 38	100	24 41	100
Mid July	20 16	19 20	18 16	17 28	17 12	18 30	100	14 18	58

Owing to the lateness of the general seeding rains, which did not fall until the end of May, it was not possible to effectively deal with weed growth on the plots planted during April and May. The June planted plots were therefore placed at an advantage, as cultivation subsequent to the rains enabled the

germinating weeds to be destroyed. As a result of this, with the variety "Gluyas Early," higher yields were obtained from the June planting than from the May planting, while with the variety "Nabawa" these two plantings were about equal.

However, consideration of the average results obtained over a number of years shows that, provided weed growth is not feared, it is inadvisable to extend the planting period into the month of June. Should it not be possible to complete the seeding during May, it is preferable to plant a suitable midseason-maturing variety in April.

RATE OF APPLICATION OF SUPERPHOSPHATE EXPERIMENT.

Planted on 31st May, 1933. Variety—Totadgin. Seed—40 lbs. per acre.

Rate of Application of Superphosphate per Acre.	Computed Yields per Acre.					Average Yields per acre, 1933.	Percentage Yields, 1933.	Average Yields per acre, 1929–33.	Percentage Yield, 1929–33.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.		bus. lbs.	
75 lbs.	24 8	19 36	17 20	15 28	17 52	18 53	87	23 48	92
150 lbs.	24 16	21 28	17 52	18 8	26 56	21 44	100	25 58	100
Nil	16 32	13 4	9 52	10 48	16 32	13 22	61	15 18	59

RATE OF APPLICATION OF SUPERPHOSPHATE EXPERIMENT.

Planted on 31st May, 1933. Variety—Totadgin. Seed—40 lbs. per acre.

Rate of Application of Superphosphate per acre.	Computed Yields per Acre.					Average Yields per acre, 1933.	Percentage Yields, 1933.	Average Yields per acre, 1929–33.	Percentage Yield, 1929–33.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lbs.	bus. lbs.	bus. lbs.	bus lbs.	bus. lbs.	bus. lbs.		bus. lbs.	
300 lbs.	27 4	27 12	28 24	24 16	28 0	26 59	105	28 11	105
150 lbs.	27 4	26 48	24 48	21 52	28 24	25 47	100	26 44	100
225 lbs.	27 52	28 40	26 40	23 12	28 48	27 2	105	27 42	104

This year's experiments and the average results over five years indicate that the rate of superphosphate could be increased with advantage above 75 lbs. per acre.

Although the applications of higher rates of superphosphate give increased yields, the most economical rate under present economic conditions would probably be about 112 lbs. per acre.

SEASONAL PLANTING EXPERIMENT.

April Planting.

Planted on 19th April, 1933. Superphosphate—112 lbs. per acre. Seed—40 lbs. per acre.

Variety.	Maturity.	Computed Yields per Acre.					Average Yields per acre, 1933.	Percentage Yields, 1933.	Percentage Yields, 1928–33.
		Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.			
		bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.		
Bencubbin ...	Midseason ...	28 32	24 24	21 28	27 12	21 52	24 42	113	116*
Nabawa ...	Midseason ...	27...56	21 36	18 8	22 24	18 24	21 54	100	100
M. 26 ...	Midseason ...	21 44	16 24	16 8	16 56	13 44	16 59	77	83†
Yandilla King	Late	18 16	17 4	10 56	11 36	14 24	14 27	63	77
Nabawa ...	Midseason ...	25 20	26 40	20 32	18 48	22 40	22 48	100	100
Sutton ...	Late	22 56	18 40	10 32	13 36	13 20	15 49	69	74‡

* 1929–33. † 1932–33. ‡ 1931–33.

SEASONAL PLANTING EXPERIMENT.

May Planting.

Planted on 16th May, 1933. Superphosphate—112 lbs. per acre. Seed—40 lbs. per acre.

Variety.	Maturity.	Computed Yields per Acre.										Average Yields per acre, 1933.		Percentage Yields, 1933.	Percentage Yields, 1928-33.
		Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.					
		bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.		
Yandilla King	Late	10	0	23	44	7	44	14	0	18	56	14	53	62	72
Nabawa ...	Midseason ...	17	52	33	36	15	4	26	0	27	44	24	3	100	100
Sutton ...	Late	7	52	17	36	8	24	18	56	19	4	14	22	60	65‡
Bencubbin ...	Midseason ...	22	40	23	36	14	40	32	8	28	32	24	19	108	113*
Nabawa ...	Midseason ...	24	16	21	12	14	0	28	40	24	48	22	35	100	100
M. 26 ...	Midseason ...	16	48	16	8	11	52	22	8	20	32	17	30	78	72†
Merredin ...	Early	18	56	19	20	14	0	24	48	23	36	20	8	87	108
Nabawa ...	Midseason ...	22	48	22	16	16	0	27	28	27	20	23	10	100	100
Geeralying ...	Very early ...	19	36	17	12	11	36	21	20	21	52	18	19	79	96
Gluyas Early	Early	19	36	20	0	13	12	25	20	27	36	21	9	90	107
Nabawa ...	Midseason ...	23	36	19	4	17	4	27	44	29	36	23	25	100	100
Totadgin ...	Early	25	20	20	16	20	56	27	4	28	56	24	30	105	119‡
Carrabin ...	Early	21	28	13	12	17	52	23	4	24	24	20	0	82	92
Nabawa ...	Midseason ...	26	16	17	28	22	48	27	44	28	8	24	29	100	100
M. 35 ...	Early	17	20	12	32	16	0	21	36	20	32	17	36	72	77†
S.H.J. ...	Early	19	52	10	24	17	4	21	48	21	20	18	42	78	89
Nabawa ...	Midseason ...	27	4	12	8	22	40	30	8	27	20	23	52	100	100
Noongaar ...	Very early ...	24	48	10	56	20	40	24	16	23	12	20	46	87	99

* 1929-33. † 1932-33. ‡ 1931-33.

SEASONAL PLANTING EXPERIMENT.

June Planting.

Planted on 16th June, 1933. Superphosphate—112 lbs. per acre. Seed—40 lbs. per acre.

Variety.	Maturity.	Computed Yields per Acre.								Average Yields per acre, 1933.		Percentage Yields, 1933.	Percentag Yields, 1928-33.
		Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.					
		bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.		
Bencubbin ...	Midseason ...	20	0	23	44	23	12	24	40	22	54	108	115†
Nabawa ...	Midseason ...	19	20	22	56	21	44	20	32	21	8	100	100
M. 26 ...	Midseason ...	21	28	21	28	22	16	20	16	21	22	101	93‡
Merredin ...	Early	22	40	22	40	20	32	21	20	21	48	102	110
Nabawa ...	Midseason ...	23	4	20	32	22	16	20	0	21	28	100	100
Geeralying ...	Very early ...	23	52	21	28	22	24	21	36	22	20	104	99
Gluyas Early	Midseason ...	26	56	23	12	25	28	23	12	24	42	112	110
Nabawa ...	Midseason ...	22	16	22	8	23	28	20	32	2	66	100	100
Totadgin ...	Early	25	12	24	40	25	12	23	20	24	36	111	121§
Carrabin ...	Early	23	36	24	0	23	28	21	4	23	2	102	96
Nabawa ...	Midseason ...	22	40	23	20	23	28	20	32	22	30	100	100
M. 35 ...	Early	20	16	22	8	21	20	19	12	20	44	92	87‡
S.H.J. ...	Early	20	48	21	28	23	4	19	4	21	6	96	90
Nabawa ...	Midseason ...	22	40	21	4	22	32	20	56	21	48	100	100
Noongaar ...	Very early ...	26	16	25	36	25	36	24	56	25	36	118	115

Section 5 discarded owing to interference by outside factors.

Lack of early rains retarded the germination of the plots planted in April. They consequently germinated at the same time as the May plots after the heavy rains at the beginning of the last week in that month.

The lateness of these rains also gave the June plots an advantage over the earlier sown plots, as it was possible to destroy weed growth on them prior to planting.

The experiment definitely shows that late maturing wheat varieties such as "Yandilla King" are unsuitable for planting in the Merredin district.

The midseason maturing variety "Bencubbin" has again shown to advantage in all sections.

Of the early maturing varieties, "Totadgin" and "Gluyas Early" have given the most satisfactory yields, while "Noongaar" has again demonstrated its suitability as a very early maturing variety for late planting.

POTASH-NITROGEN EXPERIMENT.

Planted on 2nd June, 1933. Variety—Totadgin. Seed—40 lbs. per acre.

Rate of Application of Fertiliser per Acre.	Computed Yields per Acre.					Average Yields per acre, 1933.	Percentage Yields, 1933.	Average Yields per acre, 1932-33.	Percentage Yields, 1932-33.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.		bus. lbs.	
112 lbs. Superphosphate; 112 lbs. Sulphate of Ammonia	29 52	29 20	28 32	27 20	27 4	28 26	104	26 14	101
112 lbs. Superphosphate	28 40	27 52	25 36	27 28	27 36	27 26	100	25 58	100
112 lbs. Superphosphate; 112 lbs. Sulphate of Ammonia; 56 lbs. Muriate of Potash	29 12	27 52	26 56	28 0	27 44	27 57	102	25 45	99

The average results show that no appreciable increase in yield is obtained when an application of superphosphate is supplemented with either a nitrogenous fertiliser or a nitrogenous and a potassic fertiliser.

OAT VARIETY TRIAL.

Hay Yields.

Planted on 20th May, 1933. Superphosphate—112 lbs. per acre. Seed—40 lbs. per acre.

Variety.	Maturity.	Computed Yields per acre, 1933.	Percentage Yields, 1933.	Average Yields per acre, 1930–33.	Percentage Yields, 1930–33.
		cwt. qrs. lbs.		cwt. qrs. lbs.	
Mulga	Early	45 0 0	100	53 0 3	100
Gidgee	Midseason	42 2 8	95	55 1 10	104
Guyra	Midseason	41 2 8	96	47 1 6	91
Mulga	Early	43 0 24	100	51 3 5	100
Mulga	Early	41 0 0	100	49 2 12	100
Palestine	Early	38 3 20	95	43 0 10	87
Burt's Early ...	Early	42 3 4	92	46 3 19	91
Mulga	Early	46 1 4	100	51 2 4	100

OAT VARIETY TRIAL.

Grain Yields.

Planted on 20th May, 1933. Superphosphate—112 lbs. per acre. Seed—40 lbs. per acre.

Variety.	Maturity.	Computed Yields per Acre.		Average Yields per acre, 1933.	Percentage Yields, 1933.	Average Yields per acre, 1930–33.	Percentage Yields, 1930–33.
		Section 1.	Section 2.				
		bus. lbs.	bus. lbs.	bus. lbs.		bus. lbs.	
Mulga	Early	30 24	40 0	36 12	100	36 27	100
Gidgee	Midseason ...	27 24	28 0	27 32	77	36 12	99
Guyra	Midseason ...	31 8	32 16	31 32	95	36 6	98
Mulga	Early	32 8	34 32	33 20	100	37 2	100
Mulga	Early	32 24	36 0	34 12	100	37 18	100
Palestine ...	Early	30 16	29 8	29 32	87	35 22	95
Burt's Early ...	Early	29 16	31 0	30 8	78	35 26	91
Mulga	Early	40 32	36 16	38 24	100	39 6	100

This year the standard early maturing variety, "Mulga," has proved to be the best variety for both hay and grain. Its suitability for planting in the eastern wheat belt is shown by the average results obtained over a period of 4 years.

CHAPMAN EXPERIMENT FARM.

The following table shows the monthly rainfalls, as recorded at the farm during 1933, together with the averages over the past 28 years.

Year.	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June	July.	Aug.	Sept.	Oct.	Total.			
1933	11	...	93	57	391	551	257	386	135	163	1,883	28	102	2,174
Average, 28 years ...	28	44	65	44	252	426	396	278	161	100	1,613	32	27	1,853

The main seeding rains did not fall until late in May. This delay seriously hindered the destruction of weeds prior to planting, a vital factor in the production of satisfactory yields in this district.

Heavy intermittent rains then fell up to 15th June (877 points being registered within this period), causing the land to become very boggy and further delaying the seeding operations. Good growing conditions, however, prevailed for the remainder of the season.

The land on which the experiments were planted originally carried jam timber and some wattle. It was ploughed to a depth of four inches with a mouldboard plough during August, 1932; springtyne cultivated in spring, again in April, and again prior to planting. Those plots planted after the rain late in May received two cultivations prior to planting.

The following tables show the results of the experiments conducted at the farm during the year.

FALLOW AND NON-FALLOW EXPERIMENT.

Planted on 20th June, 1933. Variety—Bencubbin. Superphosphate—112 lbs. per acre.
Seed—60 lbs. per acre.

Treatment.	Computed Yields per Acre.				Average Yields per acre. 1933.		Percentage Yields, 1933.	Average Yields per acre. 1929–33.		Percentage Yields, 1929–33.
	Section 1.		Section 2.							
	bus.	lbs.	bus.	lbs.	bus.	lbs.		bus.	lbs.	
Fallow	30	6	26	36	28	21	88	16	30	104
Non-Fallow	33	8	31	3	32	5	100	15	55	100

For the first four years of the experiment (1929-32) the site has been in the paddocks used for the general farm cropping, where the three-course rotation (fallow, crop, stubble) was practised. Over this period the fallow gave an average increase of 1 bushel 40 lbs. per acre, or 14 per cent. over the non-fallow.

With a view to determining the effect of fallowing on the crop yields on land which had been under pasture for some years, the experiment was this year conducted on land which had not been cropped since 1927, but had been top-dressed with 112 lbs. of superphosphate twice during that period. This top-dressing resulted in a good sward of grasses and clovers which was grazed down each year by stock.

The results this year show an advantage in favour of the non-fallow of 3 bushels 44 lbs., or 12 per cent., but on account of the change in the location of the experiment, the results are not comparable with those of previous years.

This year it was very noticeable that the fallowed plots suffered more from boggy conditions and weed growth than did the non-fallow plots. During the growing period the crop on the fallowed plots was more rank than that on the non-fallow. However, at harvest time very little difference was noticeable in this direction.

Previous experiments, using sulphate of ammonia, at this farm have not shown any decided increased yields as a result of increasing the nitrogen supplies.

No definite conclusion may be drawn from one year's results (1933), but they indicate that other factors besides nitrogen content and moisture conservation (this latter was definitely not a limiting factor) may have an important bearing on crop yields in this and similar districts.

Incidentally the average yield from all the plots was 30 bushels 13 lbs., which is considerably higher than has been obtained on similar soil on this farm.

The results would indicate the advisability of further experiments, with a view to changing the rotation on this farm to include a longer continuous pasture period.

TIME OF PLANTING EXPERIMENT.

Variety—Gluyas Early. Superphosphate—112 lbs. per acre. Seed—60 lbs. per acre.

Planted.	Computed Yields per Acre.										Average Yields per acre, 1933.		Percentage Yields, 1933.	Average Yields per acre, 5 years.		Percentage Yields, 5 years.
	Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.							
	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.		bus.	lb.	
Mid-June	18	52	13	12	13	36	12	32	12	24	13	7	102	12	38	87
Mid-May	11	52	13	52	13	12	13	36	11	36	12	50	100	14	37	100
Mid-July	12	8	12	24	12	0	10	40	13	36	12	10	95	8	29	58

TIME OF PLANTING EXPERIMENT.

Variety—Nabawa. Superphosphate—112 lbs. per acre. Seed—60 lbs. per acre.

Planted.	Computed Yields per Acre.										Average Yields per acre. 1933.		Percentage Yields. 1933.	Average Yields per acre. 1928-33.		Percentage Yields. 1928-33.
	Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.							
	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.		bus.	lb.	
Mid-April	4	32	5	20	6	40	6	56	7	36	6	13	123	9	48	94
Mid-May	4	8	4	24	4	40	5	44	6	24	5	4	100	10	28	100
Mid-June	6	40	6	24	8	0	9	12	10	24	8	8	161	10	30	100

The difference in yields obtained from the Nabawa plots as against similar plantings with Gluyas Early is very significant. This is probably due to the quick-growing, early maturing variety competing against weed growth better than the slower-growing, later maturing variety.

The lateness of the seeding rains prevented a satisfactory destruction of the weeds on the plots planted both in April and May. Cultivation after the rain resulted in the better control of weed growth on the plots planted in June. As a result these plots show to advantage against those planted during the preceding months.

The average results over a period of years, however, show that it is of no disadvantage to plant the crop in May, but the results this year emphasise the importance of weed control. Therefore, when weeds are feared, it is advisable to delay seeding until sufficient rain has fallen to germinate the weed seeds. The resulting growth can then be destroyed by cultivation before seeding, which, if necessary, may be delayed until the month of June.

RATE OF SEEDING EXPERIMENT.

Planted on 29th May, 1933. Variety—S.H.J. Superphosphate—112 lbs. per acre.

Rate of Seed per Acre.	Computed Yields per Acre.					Average Yields per acre, 1933.	Percentage Yields, 1933.	Average Yields per acre, (10years)	Percentage Yields, (10years)
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.		bus. lb.	
60 lbs.	13 12	12 40	12 32	13 20	14 0	13 9	103	16 3	106
45 lbs.	13 4	13 12	11 52	13 4	12 40	12 46	100	15 7	100
90 lbs.	16 24	13 4	14 16	13 44	14 32	14 24	113	16 37	110

RATE OF SEEDING EXPERIMENT.

Planted on 27th May, 1933. Variety—Nabawa. Superphosphate—112 lbs. per acre.

Rate of Seed per Acre.	Computed Yields per Acre.					Average Yields per acre, 1933.	Percentage Yields, 1933.	Average Yields per acre, (9 years)	Percentage Yields, (9 years)
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.		bus. lb.	
60 lbs.	13 12	14 24	12 24	12 16	14 56	13 26	117	15 11	101
45 lbs.	11 4	13 4	10 8	11 52	11 28	11 31	100	14 59	100
90 lbs.	14 48	14 8	12 40	13 4	16 32	14 14	124	16 6	108

Both this year's results and the average results obtained over a long period of years indicate that it is advisable to plant at least 60 lbs. of seed wheat per acre at this farm. This may be influenced by the wetter climatic conditions in addition to the excessive weed growth.

RATE OF APPLICATION OF SUPERPHOSPHATE EXPERIMENT.

Planted on 24th May, 1933. Variety—Nabawa. Seed—60 lbs. per acre.

Rate of Application of Superphosphate.	Computed Yields per Acre.					Average Yields per acre, 1933.	Percentage Yields, 1933.	Average Yields per acre, 1929-33.	Percentage Yields, 1929-33.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.		bus. lb.	
Nil	10 16	10 8	10 8	10 16	11 ~~28~~	10 27	89	10 28	78
150 lbs....	12 0	12 8	11 28	11 52	11 20	11 46	100	13 29	100
75 lbs.	12 8	11 52	11 36	10 56	11 44	11 39	99	12 20	91

Planted on 24th May, 1933. Variety—Nabawa. Seed—60 lbs. per acre.

Rate of Application of Superphosphate.	Computed Yields per Acre.					Average Yields per acre, 1933	Percentage Yields, 1933.	Average Yields per acre, 1929-33.	Percentage Yields, 1929-33.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.		bus. lb.	
300 lbs....	13 4	13 4	12 16	12 40	12 16	12 40	101	14 15	105
150 lbs....	13 4	12 56	12 32	12 16	12 8	12 35	100	13 31	100
225 lbs....	12 24	12 48	10 48	11 20	12 48	12 2	96	13 51	102

The average results obtained over a period of five years indicate that the rate of superphosphate could be increased with advantage above 75 lbs. per acre.

Although applications of higher rates of superphosphate give increased yields, the most economical rate under present economic conditions would probably be about 100 lbs. per acre.

SEASONAL PLANTING EXPERIMENT.

April Planting.

Planted on 18th April, 1933. Superphosphate—112 lbs. per acre. Seed—60 lbs. per acre.

Variety.	Maturity.	Computed Yields per Acre.					Average Yields per acre, 1933.	Percentage Yields, 1933.	Percentage Yields, 1928-33.
		Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.			
		bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.		
Bencubbin ...	Midseason ...	11 20	7 36	8 40	8 16	5 28	8 16	116	144*
Nabawa ...	Midseason ...	7 44	6 16	7 44	8 8	5 52	7 9	100	100
Baroota Wonder	Midseason ...	7 20	5 12	6 32	4 56	4 8	5 38	79	109†
Sutton ...	Late	9 36	6 56	7 4	5 28	6 8	7 2	85	108*
Nabawa ...	Midseason ...	9 36	7 4	8 56	8 8	7 28	8 14	100	100
Yandilla King	Late	5 52	4 16	3 44	4 8	4 24	4 29	54	80

* 1930–33. † 1928–29 and 1932–33.

SEASONAL PLANTING EXPERIMENT.

May Planting.

Planted on 17th May, 1933. Superphosphate—112 lbs. per acre. Seed—60 lbs. per acre.

Variety.	Maturity.	Computed Yields per Acre.					Average Yields per acre, 1933.	Percentage Yields, 1933.	Percentage Yields, 1928-33.
		Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.			
		bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.		
Noongaar ...	Very Early ...	13 36	12 40	11 44	13 4	12 56	12 48	115	87
Nabawa ...	Midseason ...	12 56	9 52	10 56	11 52	10 0	11 7	100	100
Yandilla King	Late	8 48	6 24	7 12	8 56	8 16	7 55	71	89
Sutton ...	Late	11 4	9 20	12 8	12 32	13 44	11 46	112	114*
Nabawa ...	Midseason ...	9 12	9 20	11 4	12 16	10 32	10 29	100	100
Baroota Wonder	Midseason ...	6 32	5 44	6 32	7 52	6 24	6 37	63	96†
Bencubbin ...	Midseason ...	10 48	9 12	11 44	13 12	11 52	11 22	110	116*
Nabawa ...	Midseason ...	10 56	9 20	9 28	12 24	9 20	10 18	100	100
Geeralying ...	Very Early ...	9 44	8 48	9 36	10 16	13 4	10 18	100	99
Totadgin ...	Early	11 20	9 36	11 4	13 12	11 52	11 25	104	116‡
Nabawa ...	Midseason ...	11 20	10 0	10 0	13 4	10 16	10 56	100	100
Comeback ...	Early	9 28	7 20	7 44	9 36	11 44	9 10	84	86§
Carrabin ...	Early	13 4	9 44	11 36	15 12	18 40	13 39	122	101
Nabawa ...	Midseason ...	10 56	9 12	9 36	13 4	13 4	11 10	100	100
S.H.J. ...	Early	11 28	10 16	11 12	13 20	15 12	12 18	110	102
Merredin ...	Early	8 16	7 36	9 20	9 28	12 16	9 23	80	97
Nabawa ...	Midseason ...	10 24	10 0	12 8	12 56	13 28	11 47	100	100
Gluyas Early	Early	9 12	8 48	10 40	10 8	13 4	10 22	90	98

* 1930–33. † 1928–29 and 1932–33. ‡ 1932–33. § 1929–33.

SEASONAL PLANTING EXPERIMENT.

June Planting

Planted on 20th June, 1933. Superphosphate—112 lbs. per acre. Seed—60 lbs. per acre.

Variety.	Maturity.	Computed Yields per Acre.					Average Yields per acre, 1933.	Percentage Yields, 1933.	Percentage Yields, 1928-33.
		Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.			
		bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.		
Noongaar ...	Very Early ...	11 28	21 4	23 4	24 16	21 52	20 21	108	86
Nabawa ...	Midseason ...	7 28	18 56	21 12	25 4	21 36	18 51	100	100
Sutton ...	Late	7 4	18 8	19 4	23 36	18 40	17 8	92	95†
Bencubbin ...	Midseason ...	6 16	19 4	20 24	25 20	18 56	18 10	100	103*
Nabawa ...	Midseason ...	6 24	20 16	20 8	26 40	17 28	18 11	100	100
Comeback ...	Early	11 12	15 52	15 36	19 28	14 24	15 28	84	78*
Totadgin ...	Early	11 44	17 20	15 12	18 32	13 12	15 12	74	71†
Nabawa ...	Midseason ...	13 4	23 44	20 32	25 20	20 8	20 34	100	100
Geeralying ...	Very Early ...	12 56	19 44	18 32	20 16	20 16	18 21	90	90*
Carrabin ...	Early	16 8	22 24	17 28	24 8	24 24	20 54	98	92*
Nabawa ...	Midseason ...	16 8	24 24	16 24	23 12	26 24	21 18	100	100
S.H.J. ...	Early	17 20	23 52	17 4	22 32	25 28	21 15	100	93
Merredin ...	Early	17 4	19 44	17 4	18 40	23 44	19 15	87	89
Nabawa ...	Midseason ...	17 28	23 20	23 52	20 16	26 8	22 13	100	100
Gluyas Early	Early	17 52	19 36	20 48	18 48	21 52	19 47	89	89

* 1930–33. † 1932–33.

Excessive weed growth reduced the yields in both the April and May plantings. Cultivation subsequent to heavy rains which fell towards the end of May enabled the germinating weeds on the June plots to be dealt with more effectively. The result was that considerably higher yields were obtained from these plots than from those of the earlier plantings.

In view of the climatic conditions which prevailed this year, it would be unwise to draw any definite conclusions as to the merits of any one variety.

The results of these seasonal variety trials, together with the experience obtained from the bulk crops, indicate that where weed growth is a factor influencing crop yield, it is essential to delay seeding until sufficient cultivations after the rains have destroyed these weeds. Where boggy conditions prevail from excessive rains, it may be necessary to further delay seeding, and sow those varieties suitable for that time. Under these conditions it would be necessary for farmers to have a percentage of early varieties over and above their requirements for the area they contemplate sowing.

POTASH-NITROGEN EXPERIMENT.

Planted on 27th May, 1933. Variety—Nabawa. Superphosphate—112 lbs. per acre. Seed—60 lbs. per acre.

Rate of Application of Fertiliser per Acre.	Computed Yields per Acre.					Average Yields per acre, 1933.	Percentage Yields, 1933.	Average Yields per acre, 1932-33.	Percentage Yields, 1932-33.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.		bus. lb.	
112 lbs. Sulphate of Ammonia 112 lbs. Superphosphate	14 16	13 4	13 4	13 20	13 4	13 22	115	11 34	112
112 lbs. Superphosphate	11 44	11 12	12 8	10 32	12 16	11 34	100	10 21	100
112 lbs. Sulphate of Ammonia 112 lbs. Superphosphate 56 lbs. Muriate of Potash	12 20	12 56	13 52	13 28	14 0	13 31	117	11 52	115

These results indicate that a small increase in yield can be expected when a nitrogenous fertiliser is applied, and also a slightly larger increase when both a nitrogenous and a potassic fertiliser is applied in addition to superphosphate. These increased yields, however, would not cover the increased cost of such fertilisers.

FARMERS' FIELD TRIALS.

A. S. Wild, Agricultural Adviser.

Wheat Variety Trial at Karlgarin.

The wheat variety trial conducted during 1933 on the property of Mr. L. J. Grant, of Karlgarin, was located about a mile distant from the townsite on the main road to Hyden.

Six years previously the land had been cleared of its salmon, mallee and gimlet timber, the 1933 crop being the fourth. The ground had been prepared for the experiment by ploughing 3 inches deep early in July with a disc plough. It was then springtyne cultivated in August, again in September and again in March after rain. The plots were planted on the 12th and 13th of May with a combined cultivator-drill to which light drag harrows were attached.

The following are the monthly rainfalls as recorded at Karlgarin during the year, together with the average rainfall.

Year.	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sept.	Oct.	Total.			
1933	38	12	165	44	187	186	121	177	60	86	817	17	33	1,126
Average 1925–32 ...	40	32	143	73	146	174	256	171	131	98	976	65	32	1,361

Prior to planting, rain, sufficient to ensure a satisfactory germination on the type of soil under test, had fallen. This also enabled the young wheat plants to make a fairly vigorous early growth and consequently to better withstand the dry conditions experienced later in the season.

The following table shows the results obtained from the experimental plots, each of which was half an acre in area:—

Planted—12th May. Rate of seed 45 lbs. per acre. Rate of 22% Superphosphate—112 lbs. per acre

Variety.	Maturity.	Computed Yield per Acre.		Average Yield per acre.	Per-centage Yield.
		Section 1.	Section 2.		
		bus. lbs.	bus. lbs.	bus. lbs.	%
Nabawa	Midseason	20 26	23 10	21 48	98
Gluyas Early	Early	21 32	22 54	22 13	100
Bencubbin	Midseason	29 34	26 50	28 12	127
Totadgin	Early	26 0	26 16	26 8	118
Gluyas Early	Early	20 44	23 32	22 8	100
Merredin	Early	21 12	25 22	23 17	105
Geeralying	Very Early	21 26	22 28	21 57	103
Gluyas Early	Early	20 34	21 56	21 15	100
Noongaar	Very Early	16 18	17 24	16 51	79
S.H.J.	Early	20 28	16 48	18 38	84
Gluyas Early	Early	22 28	22 6	22 17	100
Carrabin	Early	21 16	19 18	20 17	91

These results indicate the suitability of "Bencubbin" as a midseason-maturing variety and "Totadgin" as an early variety. The varieties "Nabawa," "Gluyas Early," "Merredin," and "Geeralying" also gave satisfactory results. Unfortunately, the yields of the last-named variety were considerably reduced owing to shedding. The "Noongaar" plots suffered severely from the effects of lodging, owing to too early maturity and stormy weather conditions late in the season.

Light Lands Experiments at Gnowangerup.

During 1933 experiments were conducted on the property of Mr. R. M. Watterson, of Gnowangerup, with a view to determining what factors limit the yields of wheat crops on the light land of the district. The experiments consisted of Time of Planting Experiment (April, May and June)—using two varieties, Nabawa, representing the midseason varieties, and Yandilla King, the late varieties—and also a rate of Superphosphate Experiment.

The experimental plots were located about three miles north of Gnowangerup along the main road to Kwobrup. The land, which consisted of a sandy soil over an infertile clay close to the surface, originally carried scrub and mallee and was in crop for the second time. It was disc ploughed 2½ inches deep during June and early July, disced 2 inches deep in September and again in February. Immediately prior to seeding each plot was harrowed.

The following are the rainfalls as recorded at Gnowangerup during the year, together with the average:—

Year.	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sept.	Oct.	Total.			
1933	114	11	78	26	154	428	102	121	110	243	1,158	62	51	1,500
Average 20 years to 1932	56	82	88	158	227	223	232	193	178	148	1,201	67	71	1,723

The yields from the plots are set out below:—

TIME OF PLANTING EXPERIMENT.

Variety—Nabawa. Rate of Seed—45 lbs. per acre. Rate of 22% Superphosphate—120 lbs. per acre.

Time of Planting.	Computed Yield per Acre.		Average Yield per acre.	Percentage Yields.
	Section 1.	Section 2.		
	bus. lbs.	bus. lbs.	bus. lbs.	%
April 19th	10 28	10 20	10 24	99
May 18th	10 30	10 28	10 29	100
June 16th	9 48	11 40	10 44	102

Variety—Yandilla King. Rate of Seed—45 lbs. per acre. Rate of 22% Superphosphate—120 lbs. per acre.

Time of Planting.	Computed Yield per Acre.		Average Yield per acre.	Percentage Yields.
	Section 1.	Section 2.		
	bus. lbs.	bus. lbs.	bus. lbs.	%
April 19th	10 10	10 4	10 7	100
May 18th	9 0	11 14	10 7	100
June 16th	10 52	10 44	10 48	107

RATE OF SUPERPHOSPHATE EXPERIMENT.

Planted—19th May. Variety—Yandilla King. Rate of Seed—45 lbs. per acre.
Rate of 22% Superphosphate—120 lbs. per acre.

Rate of 22% Superphosphate.	Computed Yield per Acre.		Average Yield per acre.	Percentage Yields
	Section 1.	Section 2.		
	bus. lbs.	bus. lbs.	bus. lbs.	%
75 lbs.	10 0	9 9	9 35	90
150 lbs.	10 36	10 51	10 43	100
225 lbs.	11 24	10 30	10 57	102

The results of the Rate of Superphosphate Experiment indicate that 75 lbs. of superphosphate per acre is not sufficient for this class of soil and that higher yields may be expected from applications of larger amounts.

Having regard to the satisfactory working of the land and the season, the low yields obtained, even when the time of planting, the variety and the rate of superphosphate are varied, indicate that the infertility for wheat growing is due to some other factor. Field observations appear to indicate a nitrogen deficiency, but this evidence is not conclusive.

PASTURE NURSERY PLOTS.

G. K. Baron-Hay, Superintendent of Dairying,
and
H. G. Elliott, Agricultural Adviser.

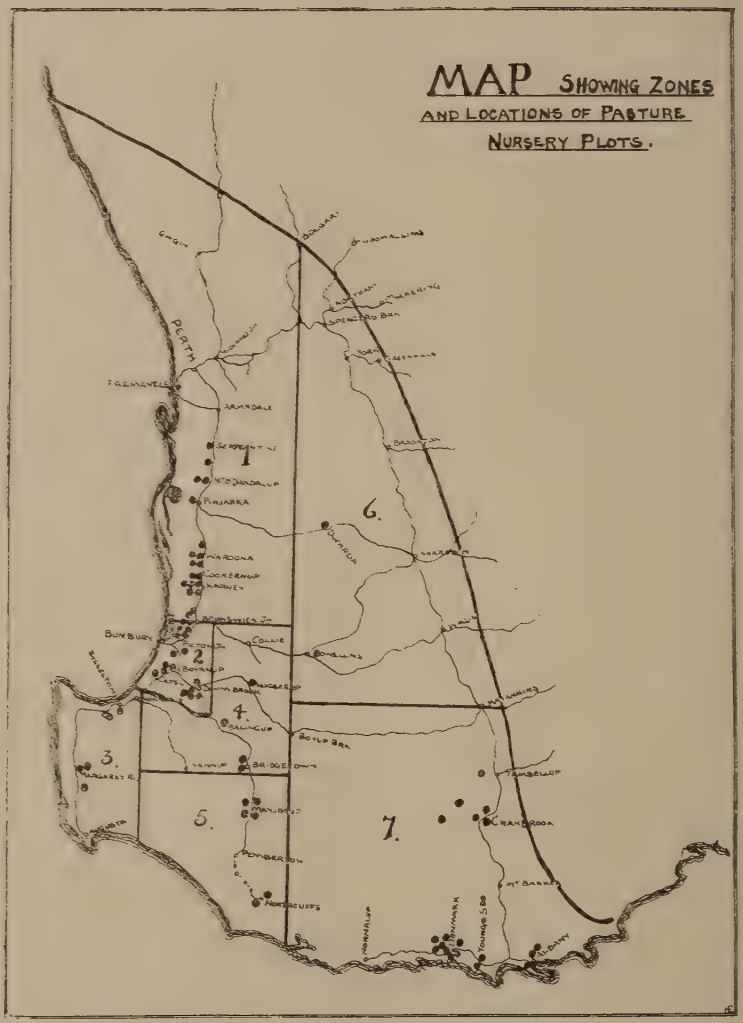
The pasture nursery plots which were conducted last season in the various districts of the State by Cuming Smith & Mt. Lyell Farmers' Fertilisers Ltd. in close co-operation with the Department of Agriculture were continued during 1933-34.

The attached map shows the South-West portion of the State divided into seven zones in each of which a number of nursery plots have been instituted.

It was hoped that, where any fodder plant should prove specially suitable to a district, these nursery plots would be used for the purpose of gathering seed which could be sown on larger areas and in a number of cases this has been done during the season just completed. Each series consisted of three plots—each 1/20th of an acre in extent, the plots being sown as follows:—

(a) Western Districts Perennial Rye Grass .. .. 20 lb. per acre.
New Zealand White Clover .. .. 2 lb. per acre.
(b) Akaroa Cocksfoot .. .. 20 lb. per acre.
New Zealand White Clover .. .. 2 lb. per acre.
(c) Phalaris tuberosa .. .. 10 lb. per acre.
New Zealand White Clover .. .. 2 lb. per acre.

Fertiliser.—All plots were fertilised at planting with super and ammonia No. 3 at the rate of 300 lb. per acre, and again in April, 1933, with the same fertiliser.



The following are the results after the second season's growth, each zone being treated separately—

ZONE 1.

Centre—Waroona. Rainfall—30-40 inches.

Twenty plots were established in 1932, 14 being continued through 1933.

Perennial Rye Grass.—The germination of rye grass was exceptionally good on all plots, the average being 85 to 90 per cent. Approximately 60 per cent. of the total sowing persisted through the first summer and grew in the second year. The growth, however, was not healthy, the grass being yellow and not vigorous

even after an application of 300 lb. super and ammonia No. 3 per acre. On the irrigated areas, however, the growth was very promising.

Cocksfoot.—Germination approximately 45 per cent. the first year, only 30 per cent. surviving the first summer. This grass is unsuitable for the average unirrigated land in Zone 1.

Phalaris tuberosa.—Approximately 56 per cent. germination which is considered satisfactory for this grass. Persistency during the first summer was high, being approximately 70 per cent.

A number of plots have not been well prepared, resulting in weed growth which probably affected the persistency.

This grass is without doubt the most outstanding one in the trials, showing a vigorous healthy growth during the second year and producing a bulk of feed throughout the season.

New Zealand White Clover.—In almost all plots this clover was a failure, due to attacks by the red mite and lucerne flea.

It is probable that the only areas where this clover will succeed are those that are irrigated and where spring planting may be practised in order to avoid attacks by the above pests.

ZONE 2.

Centre—Burekup. Rainfall—40 inches.

Eighteen plots were established in this zone in 1932, 15 being continued during 1933. All plots were top-dressed in April with 300 lb. super and ammonia No. 3 per acre.

Perennial Rye Grass.—Average germination good (85 per cent.), approximately 60 per cent. surviving through the first summer.

The plots, generally, were of an unhealthy green colour, but in three instances—on alluvial soil—good results were being obtained.

This grass is not recommended except on the richest soils.

Akaroa Cocksfoot.—Germination approximated 70 per cent., the carry over, however, during the first summer being very low.

This grass is quite unsuited for average conditions in Zone 2.

Phalaris tuberosa.—Germination and growth were slow during the first year and, it was thought, disappointing. During the second year, this grass was outstanding, approximately 90 per cent. of those plants which germinated living through the summer.

On two plots where weed competition was great in the early stages, the young Phalaris plants were smothered.

The most promising perennial yet tried for Zone 2.

White Clover.—As in zone 1, this clover is generally a failure when sown in the autumn, owing to attacks by red mite and lucerne flea. Only one plot was successful. On irrigated areas, however, where spring sowing can be practised, good results are obtained with this plant.

ZONE 3.

Centre—Margaret River. Rainfall—30-40 inches.

Five plots were established in 1932, and were continued in 1933 after receiving a top-dressing in April with super and ammonia No. 3, at the rate of 300 lbs. per acre.

Perennial Rye Grass.—The average germination was high (80 per cent.), of which 60 per cent. persisted through the first summer.

This grass was not a success, particularly owing to water-logging of the country, and no adequate drainage system being adopted.

Cocksfoot.—Below Margaret River, on good land, this grass has possibilities, but was not a success on all plots, partly owing to faulty soil preparation and excessive weed growth.

Phalaris tuberosa.—Sixty per cent. germination, and of this approximately 60 per cent. survived the first summer. The growth, however, in Zone 3 has not been equal to that in Zones 1 and 2.

White Clover.—On only one plot was this clover successfully established. This plot was on new ground, free from red mite and lucerne flea. The other plots were a failure, due to insect pests.

ZONE 4.

Centre—Donnybrook. Rainfall—30 inches.

Three plots were continued during 1933, being top-dressed in the autumn with 300 lbs. super and ammonia No. 3 per acre.

Perennial Rye Grass.—The germination of all plots was good (75 per cent.), the persistency also being higher in this zone than in any other areas (70 per cent).

A further trial is warranted with this plant in this area before definite advice can be given.

Cocksfoot.—As in the previous areas, cocksfoot did not withstand the dry summer conditions, only odd plants persisting.

Phalaris tuberosa has given good results in this zone, remaining green during the summer and providing green grazing. A very promising perennial.

White Clover.—Germination was good, but severe attacks from the red mite and lucerne flea resulted in general failure.

ZONE 5.

Centre—Manjimup. Rainfall—30-40 inches.

Five plots were established in 1932, four being continued through 1933.

Perennial Rye Grass.—In this zone perennial rye grass gave the best results of the three grasses planted. Persistency was high, and the grass appeared healthy in colour.

Cocksfoot.—In three plots the growth of cocksfoot and its persistency were good. With the advent of autumn rains this grass provides an "early bite." It is a grass that probably would succeed in this zone.

Phalaris tuberosa.—Very disappointing results were obtained with this grass in the first year, being partly due to water-logging and excessive weed competition. Of those plants which have survived, approximately 50 per cent. grew healthily during the second year.

A further trial is warranted before any definite information can be given.

White Clover.—Better results in this zone than in any other district. Persistency was good, and showed up well during the second season.

ZONE 6.

Centre—Dwarda. Rainfall—24 inches.

Perennial Rye Grass.—The germination of rye grass was excellent (85 per cent.), but only 25 per cent. persisted after the first year. It cannot be recommended for this zone.

Cocksfoot.—A gemination of approximately 65 per cent. was obtained, but only a few plants persisted during the summer. Unsuitable for Zone 6.

Phalaris tuberosa.—Germination was good, persistency being approximately 30 per cent. This is the only grass giving any promise of success in Zone 6.

White Clover.—Good germination was obtained, but no plants persisted through the summer months. Unsuited for Zone 6.

ZONE 7.

Tambellup to Denmark. Rainfall—20-40 inches.

Seventeen plots were established in 1932, 13 being continued during 1933.

This zone covers a wide variation in climate and also in soil type, and an endeavour was made to spread the plots over as wide a range as possible.

Perennial Rye Grass.—The germination throughout was exceptionally good—up to 85 per cent., and in the Southern districts a very high percentage of drought resistant plants was noticed. The colour generally, however, was not healthy except where liberal supplies of nitrogen were available.

This grass undoubtedly will become one of the main pasture plants in the extreme south coastal belt as land becomes more fertile.

Cocksfoot.—In the high rainfall areas and on light loamy slopes growing karri, cocksfoot has done exceptionally well. In low-lying wet areas it was persistent, but not producing any bulk.

Germination was fair—50 to 60 per cent. with a high percentage of persistency—a useful grass in this zone.

Phalaris tuberosa.—Throughout the whole of Zone 7 and under all soil conditions tried, this grass has given the most promising results. During the first year the growth was disappointing, but those plants which grew proved very persistent and have grown well during the second year.

A grass that can be confidently recommended in this zone, provided proper preparation of the seed bed is carried out.

New Zealand White Clover.—Only in the southern areas of Zone 7 has this clover proved successful. Where, however, red mite or lucerne flea exists, autumn planting is fatal. Provided these pests are not present, white clover may be included in all seed mixtures along the southern coast.

AREAS NORTH OF PERTH.

Four plots were established in 1933 north of Perth, namely, at Gingin, Moora, Walebing, and Irwin through the courtesy of Cuming Smith and Mt. Lyell Farmers Fertilisers, Limited. The same seed mixtures were used as in other areas.

Germination of all seeds was good, the growth, however, in all cases being very slow during the winter months.

It is not possible to give any recommendation as regards the persistency of plants on these plots until after the completion of the summer, but this will be reported at a later date.

"PINK EYE" OPHTHALMIA IN SHEEP.

A. McK. Clark, L.V.Sc.,
Chief Veterinary Surgeon.

In view of the prevalence of "pink eye" or opthalmia in sheep during this period of the year, and in response of several requests, the following article is reprinted from the "Journal of Agriculture" of September, 1932. It is also available as a leaflet at the Department of Agriculture.

This disease is caused by a germ infection of the outer covering of the eyeball, and is seasonable in its occurrence. It appears generally during the summer months, and is mostly associated with travelling sheep. The movement of sheep from one place to another facilitates its spread owing to its infectious character. When occurring on farms it causes a loss of condition in sheep, but apart from that no other economic loss eventuates. The casual germ is carried from one sheep to another by means of flies, etc.

Symptoms.—The affected sheep will be firstly noticed in their inability to follow the mob. When being driven singly the head is held erect as if the animal is endeavouring to hear in order to discover its direction. When standing quietly the head is held low in order to avoid light. In the early stages of this disease the eye or eyes are noticed discharging water freely. On examination the eye will appear deeply injected or "blood shot." From this the name is derived—"pink eye." The eye will be noticed free from foreign bodies, such as grass seeds, etc. The eye gradually becomes worse and the lids become gummy. The eyeball itself becomes opaque at a later stage. It even loses its oval shape and becomes pointed in front. It is at this stage that the animal begins to lose condition, and if affected in both eyes even runs into obstacles or water holes and becomes drowned. The disease gradually spreads to all sheep in close contact, but usually only one eye is affected.

If proper treatment is provided the sheep will gradually recover their eyesight, and spread of the disease to other sheep will be prevented. In this connection it might be as well to remind sheep-owners that it is an offence under the Stock Diseases Act to sell sheep affected with any infectious disease. The only way to avoid "Pink Eye" is to—

(1) refuse to purchase sheep from known infected flocks;

(2) examine fresh purchases and isolate them for a week, or until satisfied that they are free from disease. This is a wise procedure with all fresh purchases of live stock. If the flock is already infected remove the infected sheep into a well-shaded homestead paddock, and hand-feed and water to prevent the serious loss of condition, which will otherwise occur. The eyes of these sheep should be treated daily with the following lotion:—

Sulphate of zinc—10 grains.

Extract Balladonna—10 grains.

Water which has been boiled and allowed to cool—1 pint.

All discharges from the eyes should be removed with cotton wool, before using the eye lotion. The lotion must not be made up overstrength, or permanent damage may be caused to the eye. If unable to get the lotion made up the following lotion may be used instead:—Boracic acid, one teaspoonful, dissolve in a little hot water in a cup. Get a clean beer bottle which has previously been rinsed out

with hot water, and fill to neck with warm water which has been previously boiled, then add boracic acid solution. Shake before using. Sheep which are showing an opacity of whiteness of the cornea may be treated with the following lotion:—

Silver nitrate—1 dracham.

Water which has been boiled—1 pint.

A camel hair brush or a fountain pen filler are useful to apply the lotion, or a clean new oil can.

Every morning early the healthy sheep should be inspected to pick out the fresh cases, and these should be removed to the isolation paddock. As the sheep recover they should be put into another paddock, and not allowed to mix with the healthy sheep until all danger of infection has ceased. The sheep usually recover their sight fully and the infection will disappear in time, but the loss of condition is nearly always severe, and the amount of extra work involved in handling the flock or moving them about is often enormous.

An experiment carried out recently at the Veterinary Laboratory proved that this disease is infectious. Work is also being carried out to find out the casual organism, and if possible, to produce a vaccine which will prevent infection.

PASTURE COMPETITION—DONNYBROOK DAIRY FARMERS' ASSOCIATION.

M. CULLITY, B.Sc. (Agr.),
Agricultural Adviser, Dairy Branch.

This competition, organised by the Dairy Farmers' Association of Donnybrook, commenced with an inspection carried out in January, 1933. The present competition was judged on the same scale of points as that to be used for a major competition just commencing, which will continue over three years.

The scale of points was as follows:—

Permanency	30
Feed Value	25
Cultivation and Freedom from Weeds, etc.	10
Experimental Value	10
Bulk	25
Total	100

The following farmers' plots were inspected during January, May, and November:—

J. Egan.
A. Trigwell.
R. J. Trigwell.
J. G. Fry.
B. Langridge.
J. Hearman.

The dates of inspection were arranged so that the areas would be seen (a) at the dry season in order to assess the amount of summer grazing, etc., (b) after the first rains in order to note the proportion and vigour of any perennials present and also to note the effect of the cultural and manuring operations carried out, (c) at time of maximum growth.

The points alloted to each entrant were as under:—

Name.	Permanency. (30)	Feed Value. (25)	Cultivation and Manuring. (10)	Experimental Value. (10)	Bulk. (25)	Total Points. (100)
J. Egan	25	25	8	5	25	88
A. Trigwell	24	25	6	6	20	81
R. J. Trigwell	20	21	8	10	18	77
B. Langridge	20	19	9	10	19	77
J. G. Fry	23	23	8	4	18	76
J. Hearman	23	20	6	4	16	69

During judging the following points were considered:—

Permanency—

(a) Considered as lasting from season to season without resowing;

(b) as providing green grazing for the whole year—summer and winter;

(c) as the percentage of perennial plants present.

The ideal permanent pasture would be one on which there would be ample succulent grazing in all seasons. In our climate this is possible only on small localised areas. A pasture which gives growth during a certain portion of the year only, may be considered permanent when reseeding is not necessary. This type of pasture may be annual or perennial, the annual one having this effect of permanency when its seeding habits enable it to persist, e.g., subterranean clover. Where perennial plants were present, however, an advantage was gained, as these usually result either in earlier and more vigorous growth in the autumn and a longer growing season where the plant is a winter and spring grower, or else summer grazing where summer conditions suit that plant.

The degree of fertility of the soil is an important factor in allowing the usual perennial plants to persist in a pasture. The common perennials are usually high fertility loving plants and do not last in areas of comparative low fertility. Where it is desired to carry out trials with these plants, more fertile sections should be selected for them. If persistence is not obtained in these soils, it may be assumed with safety that trials on soils of lower fertility will not be successful. If farmers keep this point in view, much money will be saved by avoiding at the moment hopeless experimentation.

Feed Value.—This section proved difficult to interpret. When considered from a viewpoint of total nutrients in the absence of facilities for obtaining average analyses of each plot, recourse would have to be made to standard analysis of each plant, and these are so nearly alike that the section would resolve itself to a duplication of that of bulk. For example the following are quoted from Henry and Morrision, T. N. (digestible):—

Perennial Rye (hay)	47
Lucerne hay (all analyses)	51.6
Sudan hay	51.4
Lucerne, after bloom	16
Perennial Rye (green)	15.8

In view of this difficulty, recourse was made to judging this section by considering:—

(a) The estimated carrying capacity;

(b) the general attractiveness of the pasture, including vigour, palatability, etc.; and

(c) the mixture of grasses and clovers present.

It is accepted that a mixture of grasses and clovers is advisable for several reasons, one of which is to enable the stock to maintain a balance in diet by providing a variety of protein and by providing variety which will stimulate the appetite and increase the digestibility. Palatability is a most important factor and one that must be considered. Increased bulk at the cost of decreased appetite in the stock may not be profitable. Palatability also varies gradually with the fertility of the soil, but this fact does not affect the judging greatly in this competition. The variety of plants present also was considered because stock show partiality to some grasses in preference to others, and there is some variation according to the stage of growth. Further, all plants do not require the same quantities of soil constituents, so that what is not used by one may be taken up by another. An excellent example is furnished by the growing together of a clover and a grass. The clover actually leaves more nitrogenous matter ready for absorption in the ground than it can use. This additional nitrogen is readily used by grasses which may be sown.

Cultivation and Manuring.—Consideration was given to the suitability of the cultural operations carried out and also to the neglect of cultivation where this would have proved useful. Manuring was studied also from a standpoint of suitability.

Experimental Value.—Consideration had to be given to both positive and negative values, that is, not only were points allotted for excellent ideas in the establishment of pastures but also to the demonstration that certain ideas that might be popularly accepted would not stand in practice.

Reference may be made again to the fertility factor in controlling the type of plant that will exist.

Points for Bulk were given according to the estimations made at the final judging when actual weights were taken and also to the comparative growths on the plots when inspected during the year.

Comments on the pastures inspected follow:—

J. Egan.

The soil was of a varied nature containing clay, loam and sand. The original pasture consisted of kikuyu, subterranean clover, drooping flowered clover, soft brome, silver grass, and spear grass. On this, without cultivation, the following was sown on 6/5/31:—

Phalaris tuberosa	5 lb.
Cocksfoot	2 lb.
Perennial Rye Grass	2 lb.
Tall Fescue	2 lb.

This was topdressed with 100 lb. superphosphate per acre in May, and 25 lb. sulphate of ammonia in August.

When inspected in January, 1933, it was estimated that it would yield 15 tons of green material per acre, being a particularly high dense growth. In

May, 1933, the pasture was quite vigorous, but very little could be seen of the phalaris tuberosa, perennial rye, or cocksfoot. In November, 1933, the growth was again very dense and yielded 12.8 tons of green material per acre, being mostly kikuyu, drooping flowered clover, spear grass, and subterranean clover. Only odd plants of phalaris tuberosa could be seen.

B. Langridge.

Soil—heavy red clay loam sown on 10th April, 1932, with 20 lbs. rye grass collected from a persistent area in a corner of the farm. The rye was sown under cover of 1 bushel of Burt's Early oats.

Cultivation and History.—Peas and oats cut the previous year for silage. Disced in March in preparation for sowing. Pasture harrows used once during growth. This area of 1½ acres had 207 cow-grazing days between May 25th and June 27th; from September 10th to December 30th—303 grazing days. In May, 1933, the rye grass plants, showing 7½ per cent. cover, were vigorous and about 3 inches in height. The paddocks had a light fire over them during March and were tyne harrowed twice at the beginning of May. November, 1933, rye grass average height 2 ft. 3 inches to 2 ft. 6 inches, very even and carrying little subterranean clover. Topdressing was carried out with superphosphate and ammonia No. 3 at the rate of 150 lb. per acre.

A. Trigwell.

Soil.—Clay flat carrying flooded gum and blackbutt; red gum originally.

Mixture—Rye grass and subterranean clover with some trefoils and paspalum in patches.

Ground under pasture for eight years. Rye grass collected from old strain persisting in certain areas on the farm. Seed broadcasted before first rains. Topdressing—1 cwt. superphosphate in autumn and spring, May, 1933. Grazed continuously, pasture growing vigorously. November, 1933—Good mixture rye and subterranean clover. Rye not as even as that of Mr. B. Langridge. Estimated 10 tons per acre.

R. J. Trigwell.

Utilised an acre of gully land which was ploughed twice and was broken down with an iron rail and then disc harrowed.

Four lb. lucerne, 4 lb. perennial rye grass, and 3 lb. phalaris tuberosa were sown on 29th September, 1932.

At the date of the first inspection the plot was particularly promising, being still green and growing vigorously. The lucerne and perennial rye grass were very strong. The phalaris tuberosa was not plentiful but was healthy. The rye grass dried off during the summer, and the lucerne kept green. After the first rain on April 6th, all plants gave rapid growth, and in three weeks a 4-inch growth was grazed. When inspected on 23rd May, there was a 6-inch growth. In the other paddocks on the property there had been no feed until this time. Topdressing with one bag of superphospate was carried out.

The final inspection was made in November. The rye grass was excellent and of an average height of 2 ft. 6 inches. Phalaris tuberosa was scattered but healthy, and the lucerne was going back on account of the attacks of lucerne flea which were particularly severe. A further topdressing with one bag of super. and ammonia No. 3 in August, and one bag of super. in September was

given. It was estimated that 75 per cent. of the weight was rye grass. Grazing had been continued throughout the winter, stock being withdrawn at the beginning of September. This continuous grazing probably had some effect on weakening the lucerne.

J. Hearman.

Entered one acre of old pasture of which at least one-half was carrying paspalum. The other growth was couch. Subterranean clover, silver grass, spear grass, ferns, and rushes were present on this area. Grazing was continuous throughout the year. The area was topdressed with 1 cwt. on superphosphate in spring and autumn. This paddock would benefit from strong cultivation.

J. G. Fry.

Entered one acre of old pasture which was different from that of Mr. Hearman in being on a hillside. This carried a mixture of paspalum, couch, subterranean clover and mixed annual grasses. A very dense stand of grass was evident during the spring.

THE SUMMER FEEDING OF SHEEP.

E. J. UNDERWOOD, Ph.D., B.Sc., Animal Nutrition Officer.

(Published by courtesy of the Australian Broadcasting Commission, being an educational talk given through Station 6WF on 23rd February.)

The recent phenomenal rise in wool prices has made the farmer turn his attention more and more to sheep as the revenue producers of the farm. Every farmer is now anxious to carry as many sheep on his property as he possibly can and to have them producing heavy, sound fleeces of good quality. To do this he must not be seriously overstocked at any time of the year with respect to the available resources of his farm. The carrying capacity of a farm depends less on the growth of feed in the flush period than on the number of sheep that can be carried over the dry summer and early autumn. For nearly half the year, on most West Australian farms, there is usually sufficient grazing to carry about two sheep to the acre, but for the other half of the year three acres to the sheep would often be rating the grazing too highly. It follows then that if we can increase the carrying capacity during these months of each year, the carrying capacity for the farm for the whole year is correspondingly improved.

It is obviously not possible to supply green nutritious grazing throughout our long dry summer, and the dried-out grasses and stubbles which are available represent a woefully deficient ration even for mature wethers and much more so for young growing sheep and breeding ewes. It is important to realise that this is a state of affairs which occurs not occasionally or for brief periods, but for six months in every year right throughout our agricultural areas. Our summer has been very aptly described as an "annual drought," and since we cannot prevent this drought, it is essential to try and overcome or at least minimise its effects, by making the good time of the year provide for the bad. This is best done by conserving fodder in various ways in the spring for hand feeding in the late summer and early autumn.

Periodically, in practically all the sheep districts of Australia, resort has to be had to hand feeding of some sort of another. In the agricultural areas of this State I am convinced it must become a regular part of farming practice.

In order to better understand the necessity for supplementing the summer grazing with suitable foodstuffs, some idea of the seasonal changes in the feeding value of pasture must be gained. The feeding value of young green pasture at the short leafy stage is extremely high and especially suitable for growing, breeding, and milking animals. It should be the aim of every farmer to produce as much of such pasture as possible by sowing the best plant species available and by top-dressing with superphosphate regularly in early autumn. This top-dressing with super will not only increase the quantity of herbage available but will also improve its quality by stimulating the growth of clovers. The practice of top-dressing pastures is by no means sufficiently frequent among sheep farmers in this State.

As the plant species comprising a pasture "get away," i.e., as they approach maturity, their feeding value falls. This is due to the fact that they become more fibrous, less digestible, and much lower in protein and phosphate. In other words, the pasture changes in character from a rich digestible concentrate in its young green stage to a fibrous roughage, low in protein and phosphate in its mature dry stage. This falling-off in feeding value proceeds very slowly until the drying off, or ripening stage is reached, when it proceeds very rapidly. Silage and hay should be cut at the flowering and "milk" stage respectively before this takes place, so as to insure a good quality fodder. There is a very sound reason for the preference for cereal chaff of a good green colour. Farmers should avoid the all too common tendency to let hay go just a little later before cutting. Although there may be a gain in **weight** of hay, by waiting there will be a loss in **quality** and in the total digestible food produced.

From November to May over most of the Southern portion of this State, there is no regular dependable rainfall, and in consequence no growth of pasture or of crops, except in small favoured situations. This means that the food supply of the grazing animal throughout the summer is being affected in two ways. First it is being reduced in quantity owing to the fact that it is being consumed all the time and no growth is being made to take its place, and second it is being reduced in **quality** owing to the fact that the animal grazes selectively, always eating the best feed first. This selective grazing is very well illustrated when sheep are turned into a stubble paddock. They quickly eat out all the grain, then the leaf or "flag" and the bottom growth is consumed and finally they are left with nothing but pure straw on which to try and eke out a precarious living. In consequence, by March and April, and even earlier, the average farm sheep is being half starved and the food that it does obtain is very poor in quality, being particularly deficient in protein and phosphoric acid. The object of hand feeding is to increase the quantity and improve the quality of feed available in as sound and economical manner as possible.

To increase the quantity of food available, a small regular ration of about ½ lb. hay or 2 lbs. silage per sheep per day could be fed. Both these roughages are easily produced on the farm and are readily consumed when cut at the right time, and well made. Good silage is said to be rather easier to make than good hay and has the very great advantage in the summer of being succulent. Oats or wheat alone makes quite good silage for sheep, but oats and peas give an excellent product either in a tower, or in a pit where chaffing is unnecessary.

Silage has the one disadvantage of being very heavy to handle and in consequence somewhat expensive in labour. Nevertheless in some experiments at the Werribee Farm, Victoria, it was found to be considerably cheaper than hay as a means of keeping sheep in a thriving condition. Hay may be fed in racks or distributed in sheaves on the ground. Chaffing should not be necessary unless the price of hay is very high, as there is little waste with good quality long hay.

Such a method of feeding, if carried out right throughout the summer, should suffice to keep mature sheep thriving and free from gross deficiencies, particularly where a good phosphatic lick is available at the same time, but for weaners and for ewes just before and after lambing, a further food supplement is suggested to improve the quality of their ration. With weaners it is particularly necessary to start supplementary feeding early as this greatly minimises the effects of worm parasites. As has been pointed out, the two most serious deficiencies in our summer grazing are protein and phosphate. The necessity for phosphatic licks is becoming generally recognised owing to active propaganda on the part of this department. It is not realised however, that protein is equally necessary for the best returns under our late summer conditions. A small ration of oats, say ½ lb. a day per sheep, will help in this regard and is within the means of most farmers. Better still from the point of view of supplying protein are peas, lupins, and linseed nuts of which ¼ lb. per sheep per day would represent a very good supplement. Experiments have recently been carried out in the Eastern States with the slaughterhouse products blood-meal and meat-meal. These two products are composed almost entirely of protein and mineral and as little as 6 ozs. per sheep per week as a supplement to dry grazing gave increased growth in young sheep and wool increases as high at 30 per cent. It seems reasonable to expect that under our late summer conditions a similar small supplement of blood-meal or meat-meal would make good the protein deficiency and give enhanced and payable wool increases. This problem is being investigated by the department at present.

In regard to the feeding of licks it cannot be too strongly emphasised that phosphate is the only mineral known to be required and complicated mixtures containing such things as iodine, sulphur and magnesia are wasteful, unnecessary and costly. The dicalcic lick as recommended by the Department of Agriculture is palatable, it is high in available phosphate, it contains no added superfluous minerals and above all it is very much cheaper per unit of phosphate than any other lick. It should be exhibited to sheep in boxes or troughs round the watering places from the time the feed dries off until the green feed comes again. If kept constantly before them, sheep will consume about 14-20 lbs. of lick per 100 sheep per week. There is some evidence accumulating, and the question is being tried out experimentally by the department at Meckering now, that where the lick is being consumed in adequate amounts, the incidence of the depraved appetite which impels sheep to consume rabbit carcases, is greatly reduced. In this way it should be possible to greatly reduce the mortality from toxic paralysis which is due to the ingestion of a poison present in decomposed carcases. If the food supplements suggested earlier are also being fed, the value of the lick is being greatly enhanced and the chances of the sheep showing depraved appetite and hence toxic paralysis are reduced to a minimum.

In conclusion it must be emphasised that it is not thought for one moment that the last word on the summer feeding of sheep has been said with the foregoing remarks. We are sadly in need of more information on the composition of our pastures and of more feeding experiments. Nevertheless it is confidently asserted that if the feeding principles laid down are adhered to, there will be

greatly lowered stock mortality, better lambings, less unthriftiness in weaners and increased wool returns per sheep. The points of greatest importance are—

1. Conservation of ample hay or silage, or both, for feeding in small amounts right throughout the summer for the whole flock.

2. Further supplementing with oats or better, peas, lupins, or linseed, for weaners and for mated ewes just before lambing.

3. Regular supplies of a good phosphatic lick for all sheep.

4. The provision of small amounts, about ½ lb. per sheep per week, of meat-meal or blood-meal as a stimulant to wool growth, where other protein concentrates such as peas, lupins or linseed are not being fed.

WHEAT VARIETIES SOWN IN WESTERN AUSTRALIA.

R. P. ROBERTS, Agricultural Adviser.

The following table shows the acreages of the more important varieties of wheat sown in Western Australia for the seasons 1930-31 to 1933-34. The acreage figures, which were supplied by the Government Statistician, were obtained when the acreage forecasts were collected in August of each year.

Variety	SEASON.							
	1930–31.		1931–32.		1932–33.		1933–34.	
	Acreage. (000's)	Approximate Percentage of Total.	Acreage. (000's)	Approximate Percentage of Total.	Acreage. (000's)	Approximate Percentage of Total.	Acreage. (000's)	Approximate Percentage of Total.
Nabawa	1,724	41	1,100	33	983	28	626	18
Gluyas Early	662	16	566	17	594	17	556	16
Merredin	474	11	412	12	459	13	413	12
Federation	166	4	73	2	33	Less than 1·5	27	Less than 1·5
Yandilla King	136	3	92	3	64	2	28	,,
Bena	133	3	114	3	151	4	141	4
Canberra	87	2	77	2	77	2	79	2
Ford	81	2	82	2	117	3	120	4
Clubhead	76	2	74	2	34	Less than 1·5	4	Less than 1·5
Gresley	74	2	64	2	43	,,	42	,,
Baroota Wonder ...	71	2	62	2	49	,,	49	,,
Gallipoli	02	Less than 1·5	80	2	79	2	85	3
Gluclub	58	,,	133	4	334	9	307	9
Noongaar	52	,,	89	3	145	4	196	6
Geeralying	49	,,	51	2	69	2	91	3
Dollar	38	,,	20	Less than 1·5	11	Less than 1·5	9	Less than 1·5
Waratah	25	,,	44	,,	103	3	179	5
Bencubbin	...	...	1	..	14	Less than 1·5	241	7
Other Varieties ...	242	6	186	6	185	5	186	6
Total	4,210	...	3,320	...	3,544	...	3,380	...

The most striking feature of the table is the rapid decline in acreage of the leading variety "Nabawa." Over the four-year period to which the figures refer it has dropped from 1,724,000 acres to 626,000, or from 41 per cent. of the total area to 18 per cent. Despite this it is still the most popular variety, but it appears likely to be displaced from this position in the near future.

The two early maturing varieties, "Gluyas Early" and "Merredin," have maintained their positions of second and third respectively. The percentage acreage of these two well known varieties varies but little from year to year.

"Federation" and "Yandilla King" have lost a considerable amount of their popularity, and now the acreage of each is down to less than 2 per cent. of the total.

The varieties "Noongaar" and "Waratah" have both shown a considerable increase in acreage, the former on account of its suitability for planting in districts where early maturity is essential for success.

"Gluclub" increased very rapidly in the first three years of the period under review, but its rate of increase now appears to have ceased.

Probably the most spectacular advance has been made by the new midseason variety, "Bencubbin." Only one thousand acres were sown in 1931-32 and this had increased to 241,000 acres two years later. It is likely that next season this will be the most extensively grown variety in the State. It is a variety almost identical with "Nabawa" in morphological characteristics, but it has proved itself a better yielder.

The total acreage of "strong" or "premium" wheats amounted to 0.7 per cent. of the total in 1930-31, 0.8 per cent. in 1931-32, 1.0 per cent. in 1932-33, and 0.9 per cent. in 1933-34.

The accompanying table shows the percentages of late, midseason, and early varieties (areas of 5,000 acres and over) sown in the four years under review. It will be observed that there has been a gradual but definite movement from late to midseason varieties and again from midseason to early varieties.

Maturity.	Season.			
	1930–31.	1931–32.	1932–33.	1933–34.
Late varieties	Percentage of total. 7	Percentage of total. 5	Percentage of total. 4	Percentage of total. 3
Midseason varieties ...	60	57	56	56
Early varieties	33	38	40	41

RESUMÉ OF INFORMATION REGARDING FEED FLAVOURS IN BUTTER.

Paper read at Conference of Dairy Factory Managers and Secretaries' Association, Perth, 1934.

G. K. Baron-Hay,
Superintendent of Dairying.

In suggesting the subject for my address as a resumé of our knowledge of food taints in butter, and their control, it was in the belief that the elimination of feed taints is the major problem facing manufacturers of butter in Western Australia to-day, and the seriousness of the problem has been accentuated since this State entered the export trade. The palate of the local consumer has become accustomed to the peculiar flavour of Western Australian butter, not at all unpleasant, and this peculiar flavour is not noticed until butters from other areas are tasted.

On the British market, however, this "feedy" flavour, as it is called, is undesirable because of its departure from the accustomed taste.

A survey of London reports on butter exported from this State shows that, except in a very few instances, our butters were degraded on account of this "feed flavour" though rarely penalised for manufacture, a typical London grading report being "strong feedy flavour—good body and texture, 89-90 points," a butter which, otherwise, would be choice.

It is estimated that these flavours depressed the average price of factory butters by at least 1d. per lb., which on the factory production for 1932-33 amounted to no less than £40,000, and it will be agreed that this is a most conservative estimate. This loss at the present price of butter fat is approximately 12 per cent. and equivalent to a loss of £14 per annum for each 20 cows milked, and thus constitutes a serious drain on the industry.

The whole subject of odours and flavours in milk, cream, butter and cheese is greatly complicated by the fact that there is a wide range in the ability of different individuals to detect and distinguish them. Flavours and odours plainly evident to one person are unnoticed by another. Undoubtedly also, in many instances, odours or flavours in cream charged to the feed or cow, are due to contamination of the product in the stall or elsewhere, after it is drawn from the cow.

The literature on the question of feed taints in dairy produce is very scanty, particularly as regards suggested means by which these feed flavours may be eliminated.

Feed flavours found in cream and subsequently in the butter manufactured therefrom may be classified under two main headings:—

(a) Flavours absorbed from feeds after the milk has left the cow.

(b) Flavours present in the milk when drawn from the cow.

This first class of feed flavours presents little difficulty.

Milk or cream should not be stored near such substances. Fodders referred to in this connection would be—onions, fish, apples, cheese, bacon, etc. These flavours also can be readily detected on the grading floor, and the farmer advised accordingly.

The second class, namely, the treatment of feed flavours already present in the milk when drawn from the cow, presents far greater problems.

It is on the elimination of these flavours that information is desired, and it is believed that finality can only be arrived at by tackling the problem locally, as methods of elimination as a result of investigations carried out in other areas or other countries with different pasture plants may not and, indeed, have not proved successful in this State.

It is generally recognised that such plants as rape, cabbages, turnips, wild garlic, swedes, etc., will give a feed taint to milk and cream, and experience has shown locally that subterranean clover pasture will give a decided feed taint to milk and cream, and thus to butter. Recent observations, however, have cast strong suspicion on a number of indigenous plants occurring in the high rainfall areas, such as Opercularia sp., Penny Royal (Mentha Pulegium), Jam tree (Acacia acuminata), Batchelor's Button (Cotula coronopifolia) which when eaten by cows impart a decidedly unpleasant flavour to milk and cream. **Unfortunately, it has been inferred generally that these flavours are due to volatile and aromatic chemical compounds, and that being volatile they may be removed by various mechanical devices designed, generally, to cause steaming which will remove these volatile substances.** A study of the available facts shows that this is far from being the case.

In an investigation by Roadhouse and Koestler into the constituents of milk affecting its "taste." in 1929, some interesting facts regarding feed flavours were noticed.

If clean milk be placed in a collodion filter and then hung in distilled water which is flowing constantly, it was found that after 15 hours the residue in the container was composed mostly of the fat and milk proteins, while the sugar and soluble salts had passed from the container into the distilled water.

It was found that the residue was tasteless and that the taste of the milk was due to the substances that had passed through the collodion filters.

The fat and casein of clean milk impart practically nothing to the taste, contrary to popular opinion. This taste, for convenience, may be called the "primary" or "foundation" taste of milk.

When milk with a decided feed or "secondary" taint was subjected to the same treatment, it was shown that the feed taste was found very largely in the residue, and as it did not pass through the filter was thought to be either combined with the protein or dissolved in the butter fat.

If the former supposition is the correct one, then such flavours can be almost eliminated by careful churning and washing so as to reduce the curd content of the butter to a minimum.

If the flavour is dissolved in the butter fat, elimination may not be easy and may be impracticable under present day factory conditions, as it is extremely difficult to remove dissolved flavours from fats.

Indeed, the power of fats to dissolve essences is used by perfume manufacturers in Europe to remove the desirable aromas from flowers. In the "Enfleurage Process" for extracting perfumes, a thin layer of the flowers is laid on a layer of fat (animal) and kept at a warm temperature, the fat absorbing the perfume. The fat is then treated with petroleum ether in order to remove the perfume but always retains sufficient of the aroma to be sold as a pomade.

It thus will be realised how difficult the removal of such dissolved feed flavours would be in a factory.

Another means by which flavours classed as "feed taints" may gain access to dairy produce has been indicated by Orla Jensen, of Copenhagen, Weigmann and others. These investigators have pointed out that, when certain fodders are eaten containing pungent principles, these may pass into the milk through the udder but do not impart a disagreeable flavour until broken down by certain groups of bacteria. In some cases it has been possible to isolate bacteria giving a turnip flavour to milk, and in another a carrot flavour, without these substances having been fed to the cow.

It also was shown that the groups of bacteria effecting these changes belong to the "coli" and "putrefactive" groups which liquefy nutrient agar media.

From the foregoing it thus will be seen that flavours derived from the cow may be sub-divided into three classes:—

(a) Flavours produced by aromatic volatile compounds.

(b) Flavours due to compounds which are aromatic and are dissolved in butter fat.

(c) Flavours due to contamination with certain bacteria, which break down compounds present in the milk, producing food flavours.

(a) Dealing with the first class, it has been shown that these may be almost eliminated by the combined action of the farmer and the factory manager.

Aeration and cooling on the farm over any approved water cooler removes a considerable proportion of these flavours; the work, however, must be completed at the factory.

Neutralisation of the cream while between 90-100 deg. F. is found to be of great assistance and is stated by certain authorities to be more efficacious than the pasteurisation at flash temperatures of 185 deg. F. to 190 deg. F., owing to the very short exposure at these high temperatures, and this opinion is borne out by results in this State.

Heating of cream under vacuum, as is carried out in so-called deodorisers, has given good results in New Zealand and New South Wales. London grade returns so far to hand for butter manufactured with a deodoriser in Western Australia show that there is less feed taint on arrival in London, and the butter has held up to grade reasonably well.

Further information is required, however, before any definite recommendation can be made for this State, though it is reasonable to believe that this class of flavours can be efficiently eliminated.

Class (b)—those dissolved in butter fat present very serious difficulties. It is impossible at this stage to state whether this type of flavour is affecting our butter. What evidence is available, however, points to the probability that the position is not serious. Throughout the flush season the London gradings of butter showed that certain factories were able to manufacture butter which held its grade, and receive a comment of only "slight feed taint." None of these factories, however, were consistently good, indicating that the elimination or reduction of the feed flavour was due to some factory process.

If the fodder flavours—and in this case the dominant flavour undoubtedly would be "clover taint"—had been dissolved in the fat, butters would have been consistently graded "high clover taint." Here also pasteurisation would have little effect in reducing these flavours.

The third class (c), where feed taint is associated with bacterial contamination, is more easily controlled than flavour falling in the previous class (b).

What evidence is available points to these series of taints being the dominant cause of deterioration in export butters in Western Australia.

It is a significant fact that in the second year of export, London gradings called this flavour "cowy," later changing the description to "clover" or "strong feed taint" after the Senior Commonwealth Grader (Mr. F. Wigan) had visited this State.

There is also the fact that in those butters so graded, it is known that this flavour becomes intensified. This is in keeping with an association of bacterial origin even though development may be very slow at cool storage temperatures. Slight feed flavours due to volatile substances, on the other hand, tend to decrease with storage.

There is also the fact that butters from areas devoid of subterranean clover have been found to hold to their grade reasonably well under export conditions.

It is known that in one factory, where a special effort was made for two weeks during October, butter of up to choice quality was exported, and the consignments held up to grade well, feed taint being very slight.

In view of the above, it is suggested that the "feed taints" in our butters during the flush months may be due to contamination of cream with "liquefying" or "coli" bacteria, which break down a basic substance obtained from ingested subterranean clover. Conn, Orla Jensen, Esten, Wolff, and others have

shown that at temperatures not far below 41 deg. F. the growth of this type of liquefying bacteria is not inhibited, and this is the usual holding temperature of cream prior to churning.

Should this theory prove correct, elimination of feed flavours **will not depend on particular machinery but on careful attention to cleanliness from farm to factory, and during the manufacturing processes.** It will be essential for pasteurisation also to be carried out efficiently.

The question of correct grading now assumes greater importance than ever (if that were possible), as only by elimination of all creams carrying undesirable bacterial taints can there be some degree of certainty of preventing these flavours from being produced.

The important question of elimination of feed taints, however, in Western Australia can only be solved by original research work being carried out in this State.

The nature of the investigation will call for close team work between factory managers, the Field Staff of the Dairy Branch, the Government Botanist and the Technical Staff of the Laboratories of the Department of Agriculture. It is hoped that it will be possible to undertake some of the work this coming season.

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NOTES ON THE DARTMOOR AGRICULTURAL AREA.

By E. S. Simpson and L. J. H. Teakle.

GENERAL AND HISTORICAL.

Dartmoor is an agricultural district in the early stages of development, lying about 75 miles to the north-east of Geraldton and centering about Lat. 27deg. 50 min. S. and Long. 110deg. 10min. E. The subdivided area, stretching southward from the Murchison River, is 35 miles in length from north to south, and 12 miles in width. The southernmost quarter of the area, conveniently referred to as South Dartmoor, is separated from the northern portion, North Dartmoor, by the No. 3 Rabbit-proof Fence, which runs east and west.

Before subdivision, a large part of the area had been used for sheep grazing under pastoral lease. As far back, however, as 1911 about twenty 1,000-acre agricultural blocks had been surveyed in South Dartmoor, and others again in

1920-1. A number of them were occupied by R. Olivier, the Wandalong Syndicate, and others; R. Olivier growing the first crop of wheat in the district in 1926, and the Wandalong Syndicate having a small area (220 acres) under crop in the following year.

In 1929, Surveyors Brockway and Nunn surveyed and classified the remainder of the area, cutting it up into 201 further blocks ranging from 1,000 to 2,600 acres in area. In addition, 41 blocks were surveyed down the south bank of the Murchison River to the west of Dartmoor.

Towards the end of 1929, none of the most recently surveyed blocks having been occupied, the Wandalong Syndicate offered to assist the Government in preparing and managing an experimental plot in North Dartmoor to determine its

possibilities in regard to wheat growing, and an area of 100 acres in the south-west corner of Location 9104, twenty miles north of the rabbit-proof fence, was chosen by the Surveyor-General for this purpose. A road was cut through dense bush to this block by October, 1930, and by the same time the native vegetation (large cypress, mallee, carara, etc.) on the plot was cut down, but not burnt off till the following January. In May, 1931, one-half of the area was sown for the first time with wheat of three varieties, and with one variety of oats. A second series of experimental plots were grown on the same area for the Government in 1932.

The total area subdivided in the district measures 378,000 acres, classified as follows:—

	First Class.	Second Class.	Third Class.
Acres	205,000	125,000	48,000

By the end of 1931 the area of land selected was—

	First Class.	Second Class.	Third Class.
Acres	27,500	22,650	12,750

Total—62,900 acres.

Altogether there were 4,750 acres under cultivation by thirteen different landholders in the 1932 season.

COMMUNICATIONS.

The Government railway now reaches from the deep-sea port of Geraldton to Yuna, a distance of 46 miles. From here a single well-ballasted road stretches to the south end of the Dartmoor area, and continues as a cleared track, with short stretches of ballast, northwards through the centre of it as far as the Government experimental block (Location 9104). Distances from Yuna are:—

To north end of Yuna holdings	10 miles.
To south end of Dartmoor holdings	18 miles.
To Wandalong homestead	28 miles.
To No. 3 Rabbit-proof Fence	32 miles.
To Government Experimental Block 9104	52 miles.

From the Rabbit-proof Fence crossing at 32 miles a branch road leads off to the east and north-east following up the boundary between the North Dartmoor blocks and Hoses grazing blocks 7220, etc. This road is only ballasted over a few short lengths.

The Railway Advisory Board visited the district in 1932, and a railway survey is now being made approximately along the route of the main road as far north as the Government experimental block. No serious difficulty should be experienced in locating an inexpensive route for it.

TOPOGRAPHY AND GEOLOGY.

Leaving Geraldton one passes up the gentle incline of the Chapman Valley towards Yuna with Precambrian gneiss, traversed by dolerite dykes, occupying the wide bed of the valley. The ridges on either side, which are about 500 feet high at the mouth of the valley, are capped by horizontal sediments forming a gently rising plateau, on to which the Chapman railway emerges a little to the south-west of Yuna. From Yuna right through to the Murchison River there

stretches an undissected plateau of sedimentary material, which A. Gibb Maitland*, according to his geological map of 1920, considered to be of Jurassic Age. The plateau has an average elevation of 800 to 900 feet above sea level and extends westward to the ocean between the Hutt and Murchison Rivers. It is only dissected by the valleys of those two rivers.

T. Blatchford† suggests in a report dated 1927 that the underlying formation at Dartmoor may consist of sediments of Carboniferous Age forming a northward continuation of beds of that Age occurring at Eradu on the Geraldton-Mullewa line. The present writers observed Cretaceous chalk and greensand overlying what are probably Jurassic sandstones at the lower end of the Murchison gorge for at least ten miles in from the sea, but were not able to collect any evidences of age in or near Dartmoor.

The only rock outcrops in the Dartmoor district are very small and very scattered, the whole area being thickly covered with sandy or loamy soil The few bores, wells, pits and surface outcrops which have been examined indicate, however, a total absence of granite, greenstone, or metamorphic schist. In every case, whatever their age, the underlying rocks have proved to be sandstones, shales, and conglomerates, together with a lime carbonate series, which includes dolomite, limestone and both nodular concretionary, and powdery incoherent, calcite.

The lime series is particularly interesting, and must have some bearing upon the fertility of the district. Low domes of hard white, often brecciated, limestone are scattered at intervals over the area between Location 9201 (10 miles north of the rabbit-proof fence) and Olivier's block (4996) on the southern boundary of the Balla and Dartmoor groups. These rise to a height of at most five feet above the prevailing soil, and are associated with the better class country. An analysis of a very dense cream coloured "limestone" on Location 5194 showed it to be a practically pure dolomite Three other outcrops were more normal limestones (see Appendix 1.) The approximate compositions of the four were:—

Site, Block No.	5194 S. end	5194 N. end.	9211 E. side.	9212 S. end.
Calcium carbonate	50.9	71.8	64.3	74.2
Magnesium carbonate ..	40.0	18.4	13.2	9.3

Portions of the limestone outcrops are grey in colour, as though affected by bush fires, and when freshly broken exhale a distinct odour reminiscent of hydrogen phosphide and sulphide. Tests of several pieces for bitumen and phosporus revealed, however, none of the former and only the usual traces of the latter. The odour is evidently due to pyrolysis of organic matter by scrub fires. In other places, where no hard limestone showed at the surface, powdery or concretionary calcium carbonate was found in more or less abundance in the subsoil, particularly on the north boundary of Block 5199, close to the Wandalong Syndicate's experimental plots. Particulars of this will be found in Appendix IV., Table IV.

The surface of the better country is almost perfectly flat, but the poorest sandy and scrubby country has developed, under wind action, loose sand ridges rising to 50 feet above the average level. These are particularly noticeable to the south-west of the Dartmoor area, but smaller ones are occasionally seen in the heart of the subdivided tract, for example, in the vicinity of Locations 5212 and 9204.

Only a few very small clay pans were noted in the subdivided area, but beyond the east side of it, typical Murchison mulga country begins, and there are some well marked salinas or salt marshes (Narramine "Lakes").

* Then Government Geologist. † Present Government Geologist.

Water courses of any kind are absent except for the mature bed of the Murchison River, which forms the northern boundary of the area.

CLIMATE.

Dartmoor lies in latitude 28deg. South, 70 miles from the Indian Ocean (without any intervening range), at an average elevation of 900 feet above sea level, between the 10 and 12½-inch isohyets, and within the region of winter rainfall. These are the main factors governing the climate.

The nearest point for which average temperatures are available is Chapman State Farm, which is about 60 miles from the centre of Dartmoor. The records for Chapman are:—

	Jan.	Feb.	Mar.	April.	May	June.
Maximum (average) ..	92	93	89	83	73	67
Minimum (average) ..	63	65	61	58	51	48
	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Maximum (average) ..	66	67	71	75	84	89
Minimum (average) ..	46	46	48	50	56	60

Mean annual—Maximum (average) 79; minimum (average) 54.

The Commonwealth Meteorological Bureau considers that Dartmoor temperatures would probably be very close to these figures.

Occasional frosts have been experienced at midwinter at South Dartmoor, but there are never any spring frosts which would imperil the fertilisation of the wheat.

Rainfall records are available for Wandalong Estate (Location 5190) and Yallalong Homestead on the Murchison River 30 miles to the north-north-east of the centre of Dartmoor. For two years (1931-2) records were also taken at the Government block 9104 (North Dartmoor) during the wheat-growing period (April to October).

The Wandalong returns in points (100 = 1 inch) for the past seven years are:—

	Jan.-March.	April-June.	July-Sept.	Oct.-Dec.	Total.
1927	623	376	409	87	1,495
1928	263	424	309	81	1,077
1929	381	472	143	49	1,045
1930	94	553	296	66	1,009
1931	12	376	429	118	935
1932	303	432	507	210	1,452
1933	150	331	428	125	1,034
Averages ..	261	423	360	105	1,149

On the Government block, 24 miles further north, the figures were:—

	Jan.-March.	April-June.	July-Sept.	Oct.-Dec.	Total.
1931	21	598	329	105*	1,053
1932	12	376	344†	—	—

The average annual fall for Yallalong over a period of 26 years has been 1,043 points, the lowest record being 351 in 1911, and the highest 2,073 in 1915.

For all three stations it would appear that about two-thirds of the total fall occurs in the winter months during the wheat growing period; that most of the

* December not recorded, estimated at 20 points.

† July and August only, September to December not recorded.

rest of the rain is derived from thunderstorms during January, February and March; whilst the last three months of the year are usually very dry. The above records show that during the growing period for wheat Wandalong has received from 615 to 939 points with an average of 783 points.

Owing to the comparative proximity to the coast, dews are noticeable during a large part of the year. Whilst these may assist to some extent in the growth of wheat, they are likely to interfere with harvesting, and to yield a wheat of lower quality than that produced in an area of consistently drier atmosphere, *e.g.*, Merredin.

On such an unbroken plateau of loose and comparatively fine grained soil, wind action must be seriously considered. Where the poorest soil has only developed a scanty growth of low scrub, wind action has plainly been at work piling up sand ridges 20 to 50 feet high. In the better class land, with a fairly dense protecting cover of forest and tall undergrowth, this action has not been apparent in the natural undisturbed state. The Wandalong Syndicate, however, recognising the danger of extensive clearing, has wisely decided to leave 2-chain wind-breaks of original vegetation round each 150-acre plot of cultivated land. Even in these small areas very pronounced movement of the surface was observed on one day of our visit, dense clouds of fine soil blowing across a fallow field with every strong gust of wind. Much of the lifted soil appeared to be deposited in the first wind-break, where there were drifts already over a foot in thickness in places. The finest soil particles, however, for the most part were found to have escaped this local precipitation. Analytical details of the drift material from these small deposits at Wandalong, and from a large sand ridge a little to the south-west of Dartmoor, are given in Appendix II.

It is essential that any settlers on this area be warned of the extreme danger to themselves and their neighbours of clearing the country indiscriminately without allowing adequate wind-breaks at least every half mile in each direction.

WATER SUPPLY.

This matter was the subject of a report by the Government Geologist (Mr. T. Blatchford) in 1927* and additional information was gathered by us in 1932.

There does not appear to be any surface water on any part of the area, except for short periods after heavy rain. Nor are there any creek or river beds, except that of the Murchison on the northern boundary, in which permanent or seasonal pools can form. A few scattered claypans will doubtless hold temporary supplies after rain.

Most of the soils and subsoils examined are too porous and absorbent to permit of dependable dams being excavated except in some exceptionally favourable spots. Two such places are reported by the Wandalong Syndicate on their blocks 5203 and 5205. Settlers will therefore have to depend mainly upon rain water tanks, and wells or bores.

So far as rain catchments are concerned the Government has two large galvanised iron ones on the adjacent Balla area, and until recently had a third on Reserve 12648 at South Dartmoor. This last, however, was taken down and removed in 1932. Settlers' own corrugated iron roofs may be estimated to collect about 600 gallons for every 100 square feet of area with the known average rainfall of 11.5 inches.

* Annual Report of the Geological Survey for 1927, pp. 5-17, and Plate I.

The few shallow wells which have been sunk to reach the ground water level have done so at various depths, and with varying degrees of success as regards quantity and quality of supply.

One of the shallowest wells is on Hoses block 7220, in "mulga" country, just east of the subdivided area of North Dartmoor, where water was struck at 16 feet. Although strongly brackish (256 grains of soluble salts per gallon), it is being used for all domestic purposes by the owner. A complete analysis is in Appendix III. It is obviously not suitable for human drinking, laundering, or irrigation, but is an excellent stock water.

Excellent drinking water has been obtained at 13 feet in a well on Reserve 17940 on the north side of the rabbit-proof fence, details of which are:—

Reserve 17940, Hyde Well (Government): Depth 49 ft. Water level, 13 ft. Yield, not recorded. Total soluble salts, 51 grains per gallon, of which about one-half is common salt, the balance mainly sulphates. An excellent water for all domestic uses and for irrigation.

Further west along the rabbit-proof fence, 7 miles west of the Dartmoor boundary, a bore struck water at 364 feet. The yield was 8,000 gallons a day, and soluble salt content 195 grains per gallon, which is excellent for stock watering, but too saline for regular human consumption or irrigation. No more information is available regarding water supplies north of the rabbit-proof fence, and we are of opinion that further boring should be done in this area.

In South Dartmoor a number of Government and private bores have been sunk. In order of quality of water obtained, they are as follow:—

Reserve 12648, Government Bore: Depth, 250 ft. Yeild, 12,000 gallons a day. Total soluble salts, 82 grains per gallon. Complete analysis in Appendix III. This is a good water for domestic use. Bore furnished with pump and tank.

Location 4995, Private Bore: Depth, 240 ft. (Water level, 200 ft.) Yield, not recorded. Total soluble salts 271 grains per gallon. Complete analysis in Appendix III. A good stock water, but too brackish for any domestic purpose.

Location 5200, Private Bore: Depth, 300 ft. (Water level, 221 ft.) Supply, not recorded. Total soluble salts, 921 grains per gallon; magnesia, 43 grains per gallon. This is a poor stock water, only suitable for sheep.

Reserve 13152 (Location 4992), Government Bore: Depth, 160 ft. Water salt.

Location 4999, Government Bore: Depth, 550 ft. Salt water at 225 ft., and nothing below.

Just south of Location 4991, Government Bore No. 4: Depth, 197 ft. No water.

Location 5070, eight miles west of Location 4999, Government Bore: Depth, 162 ft. No water.

Yuna road, four miles south-south-west of Location 4991, Government Bore: Depth, 202 ft. No water.

The Government Geologist's report of 1927 suggested the possibility of obtaining artesian water in the local sediments, but the only deep bore put down to 550 ft. in the south corner of Location 4999, after passing through salt ground water at 225 ft., failed to strike artesian water below. The complete absence of artesian water in the district cannot, however, be inferred from the failure of a single bore-hole only 550 ft. deep.

SOILS.

The soils reflect the climatic conditions and belong to the "Mallee Zone" types, but are distinct from the soils in any other part of the wheat belt of the State (except the adjacent Yuna and Balla areas) as a result of their derivation from geologically different material, viz., horizontally bedded marine sediments, whilst the main wheat belt soils are derived almost wholly from granite and associated greenstone dykes.

They were tentatively classified by the surveyors into first, second and third class. These were originally defined as:—

First class: Red sandy loam with dwarf York gum and yorrell south of the rabbit-proof fence, and tall cypress-pine (*Callitris glauca*) and occasionaly gums (eucalypts) north of it.

Second class: Red or yellow sand carrying Bowgada bush, carara and hard scrub.

Third class: Yellow sand dunes and sandy flats with low scrub and spinifex grass.

The total area of these three classes are recorded as:—

First Class	205,000 acres.
Second Class	125,000 acres.
Third Class	48,000 acres.

The third class land which lies just beyond the borders of the subdivided area in several directions is, of course, not included in these figures.

The soils of a number of typical areas were recently examined both in the field and in the laboratory, and as a result one of us (L.J.H.T.) has more closely defined five main groups of soil types as follow. Of them, those numbered 1A to E are subdivisions of the first class group of the surveyor's classification. Those numbered 2A and B are in the second class, and those numbered 3A and B in the third class.

(1) *Eucalyptus Forest* in the southern section.

Types 1A, 1B, 1C.—Fine grained reddish-brown sands to clay loams, generally of considerable depth and excellent water absorbing and holding capacity. Yorrell (*Euc. gracillus*), blackbutt (*E. oleosa*), York gum (*E. foecunda*), mallee, jam (*Acacia acuminata*), carara (*A. genistoides*), other wattles (*Acacia spp.*) and "wild olive" (*Bursaria spinosa*) appear to be the chief elements of the vegetation. Saltbush grows with York gum on the heavy flats in small depressions. The bulk of the present cultivation is on these soils, excluding the heavy York gum flats.

(2) *Cypress-pine Forest* in the northern section.

Types 1D and 1E.—The soils vary from shallow sands on a hard pan (usually siliceous) at about 20 inches in the depressions, to deep sands and loamy sands on rises. Large cypress pine (*Callitris glauca*) with Bowgada bush (*Acacia linophylla*), carara, scattered mallees and other shrubs are the chief elements of the vegetation.

(3) *Broom Bush and Mallee Country.*

Types 2A and 2B.—Mainly brownish sands with no tall vegetation, but characterised by the abundance of broom bush (*Melaleuca uncinata*), tea-tree (*Melaleuca spp.*), Bowgada bush, and mallee (low eucalypts). A hard pan occurs at about 20 inches in broom bush country (type 2A).

(4) *Yellow Brown Sands with Heath.*

Type 3A.—These are deep loose soils with laterite pebbles only at considerable depth (9 ft. on Location 9204).

(5) *Gravelly Sands with Wodjil and Heath.*

Type 3B.—Yellow sands with laterite gravel at surface increasing rapidly in amount with depth. Vegetation chiefly wodjil (stunted *Acacia spp.*) and heath.

Soil samples were taken from 22 sites selected to represent the major soil types of the district. Details of their examination, which are given in Appendix IV., suggest the following conclusions:—

The principal soils are of a sandy nature, which extends to the subsoils. Of the whole series, the York gum soils of type 1C are the heaviest, and the sandy heath soils (types 3A and B) the sandiest. The highest percentage of clay observed in a surface soil was 18 per cent. in a red loam from Location 9201. In the same hole the subsoil reached a maximum clay content of 26 per cent. at a depth of 12 to 19 inches, below which the clay fraction diminished again. Soils of the 3A type all contained over 90 per cent. of coarse and fine sand. Several of the better soils of types 1A, 2A and 2B carried no less than 87 to 90 per cent. See Appendix IV.

This sandy texture is a distinct advantage under the low rainfall, as the moisture is more available to the plant. Further, the texture of the soils is of such a nature that moisture is absorbed very readily, penetration is extensive and re-evaporation slow. The subsoil was observed to be moist at certain sites in November up to depths of 7 to 9 feet even in uncleared country. At another site in fallow, moisture was again observed to a depth of seven feet. Wheat roots would undoubtedly penetrate to this depth in such free soil, and make use of the stored moisture, which is equivalent to five to eight inches of rain. It is locally maintained that, because of this deep storage of moisture, September and October rains are not essential to the development of heavy yields of grain.

In regard to the physical constitution of the soils Table II. of Appendix IV. is of particular interest in that it shows the relative proportions of the different sized grains in the sand fractions. Certain significant ratios, calculated from this table and the preceding one, are set out in Table III.

It is noteworthy that the "coarse sand" fraction (2 mm. to 0.2 mm. diameter) exceeds the "fine sand" fraction (0.2 to 0.02 mm.) in every instance, the average ratio in the 47 samples analysed being 2.02, with a range of 1.02 to 4.13. Within the standard "coarse sand" group, however, by far the most abundant fraction is one of the finer ones, viz., that which passes a 30-mesh sieve, but is retained on a 60-mesh (0.42 to 0.21 mm.). This fraction averages 41.8 per cent. of the whole sand in the 47 soils. The next most abundant fraction is the finest of all, viz., that which passes a 120-mesh sieve (0.11 to 0.02 mm.).

These data from Dartmoor are compared in the table with those from Wongan Hills light lands, the soils from which resemble type 3 in many respects. The only notable difference is the lower proportion of the $-30 +60$ fraction in the latter, the deficiency being made up by an increase in the coarest fractions. These resemblances suggest an ultimately similar origin for the two soils, probably in the disintegration of a fine grained granite, though the Dartmoor sands have undoubtedly passed through an intermediate phase of sedimentation, for which in the case of the Wongan Hills soils there is no evidence.

Samples taken from the sand drifts (see Appendix II.) differ only in the practical absence of the coarsest sand, retained on a 30-mesh sieve, and in having a somewhat larger proportion of the finer material passing a 60-mesh sieve.

A hard pan at shallow depths (20 inches or so) in certain soil types will probably limit moisture absorption in fallow, and will render these types less safe for wheatgrowing than the deeper soils. Fortunately our observations indicated that the more favourable, deeper soils predominate.

Owing to their loose friable nature the surface soils are liable to deflation, which will have to be guarded against by wind-breaks and the provision of proper tilth.

From a chemical standpoint the soils would not be classed as rich in natural plant foods according to European and American standards. They appear, however, to be normal for the Western Australian wheat belt, taking the soils on the Merredin and Chapman experimental farms as standards. Detailed figures are given in Appendix IV.

The nitrogen content is low in common with that of most soils of our drier areas. It appears, however, to be readily available, judging from the crop growth observed, and by comparison with experience at Merredin.

Phosphorus is low, but this deficiency is readily and successfully remedied on the land now cultivated by the addition of superphosphate at the rate of 70 to 90 lbs. per acre. More would be advisable on the third class soils, should any attempt be made to crop them.

Potash is normal in the eucalyptus forest and cypress pine soils, but is definitely low in the scrub and heath soils. The use of potash fertilisers, however, could not be recommended for cereal crops, without proof of their economic efficiency on trial plots, as experiments with cereals in other parts of the wheat belt have shown little or no response to the application of potash fertilisers.

Lime is plentiful in the eucalyptus forest soils, particularly in the subsoils, which are generally notably calcareous (see Appendix IV.). The cypress pine country is normal with respect to lime in the surface layers, but unfortunately shows no accumulation of calcium carbonate in the subsoil. The heath and wodjil country is very low in lime. Any lack of lime as a plant food would, however, be corrected by the use of superphosphate, which is necessary to counteract phosphorus deficiency.

The salt content of the soils is generally low, and observations indicate that there will be no appreciable salt problem to interfere with the development of the district. In view, however, of the experience elsewhere in the State, it is probable that, following clearing, some salt accumulation will be noticed in the heavier depressions and incipient lakes or salinas, which fortunately form only a small proportion of the total cultivable area.

The results of tests for salinity are given in detail in Appendix IV. Summarised they are, for top-soils:—

	Min.	Max.	Average.
Sodium chloride, per cent. ..	0.003	0.036	0.010
Water soluble salts, per cent.	0.019	0.087	0.044

These figures exclude an isolated record of 0.75 per cent. of salt in a clay pan. The highest percentages recorded in the subsoils of cultivable land to a depth of nine feet were:—

Sodium chloride, per cent.	0.153
Water soluble salts, per cent	0.281

As regards reaction, the cypress-pine soils, the scrub soils (second class), and the pure sands and gravelly sands of the heath and wodjil country (third class) are all acidic. This is not a serious matter *per se*, but probably indicates a lower level of fertility than that of the eucalyptus forest soils.

Summarising the soil conditions from the viewpoint of cereal growing, one may state:—

(1) The eucalyptus forest soils are generally first class with respect to wheat-growing and mixed farming.

(2) The cypress-pine country is similar in fertility to the Bowgada bush country, and is to be regarded as a superior second class. In certain restricted areas, which are as yet indefinable, hard pans will reduce the productivity.

(3) The heath and wodjil country is inferior texturally and is generally of lower fertility than either of the above. Chemical differences are less striking than physical.

(4) There is no appreciable salt problem at Dartmoor.

CROPS.

The area under crop in this district in 1932 was 4,650 acres.

The system of cropping at present adopted by one of the largest growers is as follows. All stubble is burnt off at the end of the summer. The land is not disturbed until June or July, when it is ploughed, and subsequently receives no treatment till it is sown with wheat in the following late April or May with a disc drill. In alternate years each field is cropped or fallowed. On one field lupins have been grown in place of fallowing. Harvesting begins about the first week in November. The sowing is done with 40 to 50 lbs. of seed wheat and 75 to 90 lbs. of superphosphate to the acre. Fallowed land has been giving about double the yield of new or unfallowed land.

Throughout the district fallowing is essential to the production of high yields, and cultivation of the fallowed land will become necessary as weeds are introduced. It is probable that the best farming methods practiced in the eastern wheat belt with respect to cultivation, seeding and manuring will be suitable for the Dartmoor area. The introduction of stock will be necessary for keeping down weeds, building up the lighter soil types, and maintaining soil fertility.

A large number of varieties of wheat have been experimented with, including:

Bencubbin	Merredin
Canberra	Nabawa
Centenary	Noongaar
Geeralying	S.H.J.
Gluclub	Totadgin
Gluyas Early	Waratah
Gresley	

Of these it is generally considered that Merredin has proved to be most suitable for the district. One plot of this variety at Wandalong in 1931 yielded 30.7 bushels to the acre.

Reporting on the milling quality of the different wheats grown on the Government block in 1931 the Director of Agriculture considered "S.H.J." to be the best, with Bencubbin, Nabawa, Noongaar and Geeralying also of very fine quality. The Merredin in this case was somewhat pinched.

Samples were obtained of a number of the wheats grown in 1932 both at Wandalong and the Government plots on Location 9104. The moisture and protein were determined in all of these and the results are given in Appendix V., Table 1. Five of them were selected for more detailed investigation by the latest methods, including milling, analysis of flour, and determination of both quantity and quality of the protein. The figures obtained are tabulated in Appendix V., Table II. In regard to Gluclub, a wheat whose quality has been widely discussed in recent years, the figures for the Wandalong sample show a high content of protein of poor quality, resulting in a poor absorption figure, also an objectionably low maltose figure. In general it is below F.A.Q. standard. The quality of the Bencubbin and Merredin wheats grown both at Wandalong and the Government plots are well up to standards for those varieties, and superior in quality to the same wheats grown at the Chapman State Farm.

Consistently high yields of grain have been obtained from all the farms in the Dartmoor and adjacent Balla districts since fallowing has been a regular element of farm management as the following figures show:—

Yield of Wheat in Bushels per acre.

Wandalong Estate.

	Non-fallow.	Fallow.
1928 ..	13.6	—
1929 ..	*13.1	—
1930 ..	13.2	27.25
1931 ..	—	26.1
1932 ..	—	†25.6
1933 ..	12.5	23.1

* Merredin gave the heaviest yield, averaging 17.2 bushels.
† 3 per cent. of area was new land just cleared.

Yield of Wheat in Bushels per acre.

Government Block 9104.

	Non-fallow.	Fallow.
1931 ..	19.3	—
1932 ..	—	*20.8

* Appreciable loss through attack by galahs (*Kakatoe roseicapilla*).

District Averages.

	Area (acres).	Yield (bushels).
1930 ..	4,739	15.8
1931 ..	3,450	18.4
1932 ..	4,534	*18.6

* One farm which planted only fallowed land obtained an average of 25.6 bushels from 795 acres.

APPENDIX I.

ANALYSES OF LIMESTONES, DARTMOOR.

No.	5260.	5553.	5554.	5555.
	Dense dolomite Loc. 5194, South end.	Limestone R.P.F., near Loc. 5194.	Limestone Road, 4m. North of R.P.F.	Limestone Road, 3½m. North of R.P.F.
SiO_2	6·24	7·27	18·95	13·14
Al_2O_3	·52	1·73	·75	2·48
Fe_2O_3	·33			
FeO	·08	...	...	...
MnO	nil	...	...	...
MgO	19·63	8·78	6·33	4·44
CaO	28·66	40·21	36·02	41·56
Na_2O	·07	...	...	...
K_2O	·09	...	...	...
H_2O +	·56	...	...	...
H_2O —	·57	...	...	...
CO_2	43·25	...	...	...
SO_3	·23	...	...	...
P_2O_5	nil	...	...	...
Cl	·04	...	...	...
	100·27			
Calculated:				
$CaCO_3$	50·87	71·77	64·29	74·15
$MgCO_3$	40·01	18·36	13·24	9·29
Analyst	Rowledge	Kildahl	Kildahl	Rowledge

PHOSPHORUS IN FETID LIMESTONE.

A.	Main Road, 50 yards South of R.P.F. ... ... P_2O_5	0·026	per cent.
B.	S. of Wandalong homestead	0·026	,,
C.	Main Road, 3½ miles North of R.P.F.	0·022	,,

Analyst A. J. Hoare.

APPENDIX II.

COMPOSITION OF DRIFT SANDS.

No.	5545.	5546.	5547.	5548.
Particle size—	%	%	%	%
Over 20 mesh	nil	0·8	nil	nil
,, 30 ,,	nil	4·1	nil	trace
,, 60 ,,	22·0	41·9	16·6	40·0
,, 80 ,,	38·5	14·7	28·5	29·9
,, 100 ,,	13·4	7·0	13·2	7·4
,, 120 ,,	11·0	4·4	9·3	4·3
Under 120 mesh	13·3	19·5	21·5	11·0
Silt	·3	1·7	·3	·6
Clay	1·5	5·8	5·1	5·1

Analyst: B. L. Southern.

5545. Top of large sandridge between Locs. 8360 and 8239. South Dartmoor.
5546. Undrifted sand plain at foot of ridge where 5545 was taken.
5547. Yellow drift from fallow, Wandalong Estate.
5548. Deep red drift from fallow, Wandalong Estate.

Appendix III.

ANALYSES OF WELL WATERS.

No.	5078.		5079.		5080.	
Source ...	240ft. Bore, Loc. 4995.		250ft. Bore, Res. 12648.*		16ft. Well, Loc. 7220.	
	Parts per million.	Grains per gallon.	Parts per million.	Grains per gallon.	Parts per million.	Grains per gallon.
Calcium carbonate ...	97	6·79	42	2·94	210	14·70
Magnesium carbonate	32	2·24	24	1·68	42	2·94
Magnesium sulphate ...	405	28·35	107	7·49	350	24·50
Magnesium chloride ...	200	14·00	8	·56	219	15·33
Sodium chloride ...	3,095	216·65	931	65·17	2,646	185·22
Potassium chloride ...	29	2·03	46	3·22	107	7·49
Sodium nitrate ...	4	·28	5	·35	69	4·83
Iron and aluminium oxides	4	·28	2	·14	6	·42
Silica	2	·14	4	·28	7	·49
Total	3,868	270·76	1,169	81·83	3,656	255·92
Reaction, pH ...	8·4	...	7·9	...	7·9	...
Total hardness ...	682	47·74	170	11·90	782	54·74

* Yields about 12,000 gallons a day. Analyst: J. Pericles.

APPENDIX IV.

TABLE 1.

CHEMICAL AND MECHANICAL

Lab. No.	Type.	No. of Loc. and Sample Site.†	Depth.	Mechanical Analysis.* Stones	Coarse Sand.	Fine Sand.	Silt.	Clay.	Loss on Acid treatment.	Moisture.	Loss on ignition.	Calcium carbonate.
1932.			inches.	%	%	%	%	%	%	%	%	%
5560	1A	9159	0—1	0	70·8	18·4	1·9	9·1	0·3	0·4	2·2	...
5561	,,	(4)	1—3	0	65·3	21·3	2·3	10·3	0·5	0·6	2·5	...
5562	,,	,,	3—30	14	59·7	21·5	2·2	16·1	0·8	1·0	2·8	...
5563	,,	,,	30—52	20	48·6	27·4	5·1	8·4	7·1	2·5	6·6	5·7
5564	,,	,,	52—64	0	48·2	26·5	4·4	3·8	15·3	2·5	9·6	14·0
5611	1B	9211	0—3	0	54·7	27·5	5·1	11·3	0·4	1·1	2·6	...
5612	,,	(10)	3—9	0	48·4	26·1	5·1	18·1	1·0	2·2	3·5	...
5613	,,	,,	9—24	0	39·2	24·8	2·5	25·8	5·9	2·8	6·1	5·1
5614	,,	,,	24—74	24	31·4	17·4	1·5	20·8	27·1	2·1	14·5	24·1
5305	1C	9201	0—2	0	50·7	24·2	6·6	18·0	0·1	0·8	3·5	...
5306	,,	(13)	2—4½	0	54·3	19·7	6·3	18·6	0·4	1·0	4·0	...
5307	,,	,,	4½—12	0	45·3	23·0	8·5	22·0	0·4	1·3	4·2	...
5308	,,	,,	12—19	0	42·8	22·8	7·9	25·7	0·5	1·6	4·3	...
5309	,,	,,	19—26	10	49·9	22·0	6·5	16·4	1·5	2·7	5·8	Present
5615	1D	9202	0—2½	0	57·7	23·3	3·7	15·3	0·5	0·6	3·0	...
5616	,,	(12)	2½—6	0	57·6	22·5	2·8	16·0	0·5	0·9	3·8	...
5617	,,	,,	6—11	0	54·4	24·8	3·0	17·5	0·5	0·9	3·4	...
5618	,,	,,	11—20	0	50·0	25·7	3·2	19·3	0·5	1·3	4·0	...
5619	,,	,,	Below 20	28	44·8	22·5	5·7	11·9	12·1	2·4	9·3	12·0
5145	1E	9104	0—1	0	67·0	19·6	3·2	9·9	0·4	0·3	3·4	...
5146	,,	(1)	1—11	0	70·4	17·0	1·3	10·5	0·2	0·4	2·6	...
5147	,,	,,	12—30	0	57·6	25·7	2·1	14·7	0·2	0·4	2·6	...
5148	,,	,,	30—60	0	59·6	24·2	2·5	13·6	0·1	0·5	2·6	...
5149	,,	,,	60—79	0	62·4	23·2	2·3	11·3	0·2	0·6	2·4	...
5150	,,	,,	79—116	0	66·2	26·2	0·9	4·2	0·5	0·7	2·9	Present
1933. 48	2A	5204	0—4	0	55·0	32·7	2·7	8·8	0·4	0·5	3·0	...
49	,,	(21)	4—10	0	52·2	32·7	3·1	10·5	0·3	0·8	2·9	...
50	,,	,,	10—18	0	46·1	35·2	3·3	13·7	0·3	1·2	2·7	...
51	,,	,,	18—20	20	49·3	28·7	3·9	12·6	3·5	2·2	4·6	2·3‡
1932. 5245	2B	5198	0—12	0	53·4	34·3	1·4	10·7	0·2	0·5	2·1	...
5246	,,	(20)	12—30	0	49·3	36·8	1·7	12·8	0·1	0·6	2·0	...
5247	,,	,,	30—52	0	43·2	39·9	2·1	15·3	0·1	0·8	2·5	...
5248	,,	,,	52—60	0	39·8	35·3	5·4	16·3	1·1	2·1	3·8	Present
5275	1A	8772 (23)	0—6	0	44·6	45·2	1·7	6·9	0·4	0·6	2·0	...
5153	3A	North of 5207	0—2½	0	63·6	29·6	1·0	5·6	...	0·2	2·1	...
5154	,,	(8)	2½—9	0	64·7	28·5	0·8	6·1	...	0·3	1·7	...
5155	,,	,,	9—30	0	61·4	30·9	1·2	7·0	0·1	0·3	1·8	...
5156	,,	,,	30—60	0	54·6	37·5	1·3	6·9	0·2	0·3	2·1	...
5157	,,	,,	60—104	0	52·2	40·8	1·5	5·9	0·2	0·3	2·2	...
5299	,,	9204	0—4	0	68·9	25·6	1·1	4·3	0·1	0·2	1·6	...
5300	,,	(11)	4—9	0	59·4	34·4	0·8	5·4	...	0·3	1·5	...
5301	,,	,,	9—30	0	57·4	36·7	0·6	5·7	0·1	0·3	1·6	...
5302	,,	,,	30—60	0	53·4	38·7	0·8	6·6	0·2	0·3	1·9	...
5303	,,	,,	60—104	0	48·3	44·0	1·2	6·4	0·3	0·3	1·8	...
5304	,,	,,	104—106	43	46·3	45·6	1·2	7·0	0·1	0·4	2·1	...
5565	3B	9170	0—2½	5	61·8	30·2	2·0	6·3	0·3	0·2	3·1	...
5566	,,	(6)	2½—12	8	53·6	35·8	2·2	8·5	0·1	0·4	3·1	...
5567	,,	,,	12—21	62	48·4	39·4	2·0	9·8	0·2	0·4	3·2	...

* Mechanical analysis :—
Particle sizes :
Coarse sand 2 — 0·2 millimeters (over 70 mesh).
Fine sand ·2 — ·02 ,, (under 70 mesh).
Silt ·02 — ·002 ,,
Clay under ·002 ,,

† See accompanying Plan <
‡ Includes some $MgCO_3$

APPENDIX IV.

TABLE I.

ANALYSES OF DARTMOOR SOILS.

Colour (wet).	Nature.	Reaction pH.	Nitrogen.	Organic carbon.	Chemical Analysis. Hydrochloric acid soluble. Lime CaO.	Phos. oxide, P_2O_5.	Potash, K_2O	Water soluble salts.	Sodium chloride calc. from Chlorine.	Lab. No.
		%	%	%	%	%	%	%	%	1932.
Dark red brown	Very sandy loam	6·91	·024	...	·057	·076	·121	·025	·008	5560
Red brown ...	do. ...	6·44	·023	...	·070	·047	·140	·020	·010	5561
Do. ...	Sandy loam ...	7·34	·024	...	·131	·054	·237	·048	·012	5562
Do. ...	Coarse very sandy loam calcareous	7·64	...	...	...	...	...	...	...	5563
Pale red brown	do do.	8·01	...	...	...	...	...	...	...	5564
Dark red brown	Very sandy loam	7·78	·028	...	·162	·038	·032	·047	·008	5611
Do. ...	do. ...	8·38	·035	...	·414	·049	·249	·085	·008	5612
Brown ...	Calcareous loam	8·43	·028	...	3·215	·042	·233	·158	·079	5613
Light brown...	Calc. clay loam	8·14	...	...	...	...	...	...	...	5614
Dark red brown	Sandy loam ...	7·77	·032	...	·119	·084	·225	...	...	5305
Do. ...	do. ...	8·23	·034	...	·192	·073	·180	...	...	5306
Do. ...	Loam	8·23	·029	...	·215	·085	·253	...	...	5307
Red brown ...	Loam	8·11	·025	...	·076	·019	·058	·049	·008	5308
Do. ...	Sandy loam: hard $CaCO_3$	8·46	·032	...	...	...	...	...	...	5309
Dark red brown	Coarse sandy loam	7·12	·030	...	·157	·071	·106	·052	·008	5615
Do. ...	do. do.	6·21	·042	...	·102	·051	·121	·064	·007	5616
Do. ...	do. do.	4·92	·028	...	·064	·075	·082	·038	·008	5617
Do. ...	do. do.	6·46	·034	...	·144	·071	·090	·180	·007	5618
Do. ...	Coarse sandy loam, $CaCO_3$	7·92	...	...	...	...	...	...	...	5619
Brown ...	Very sandy ...	6·71	·041	1·535	·163	·047	·028	...	·014	5145
Red brown ...	do. ...	4·77	·025	·597	·110	·018	·021	...	·004	5146
Do. ...	Sandy ...	4·66	·013	...	·113	·019	·028	...	·003	5147
Do. ...	do. ...	6·85	·011	...	...	...	...	...	·007	5148
Do. ...	Very sandy ...	7·25	nil	...	...	...	...	...	·024	5149
Do. ...	do. ...	8·09	·006	...	...	...	...	...	·053	5150
										1933.
Dark red brown	Very fine sandy loam	5·26	·031	...	·077	·033	·059	·043	·012	48
Do. ...	do. do.	5·26	·028	...	·050	·047	·055	·087	·036	49
Do. ...	do. do.	6·48	·027	...	·671	·020	·108	·153	·064	50
Do. ...	Sandy loam, $CaCO_3$, $MgCO_3$	7·88	·028	...	·800	·022	·173	·281	·115	51
										1932.
Do. ...	Very fine sandy loam	5·33	·019	·196	·102	·026	·062	...	·007	5245
Do. ...	do. do.	4·36	·015	...	·174	·022	·059	...	·018	5246
Do. ...	Very fine loam	4·96	·028	...	...	...	...	...	·024	5247
Do. ...	Very fine loam, Tr. $CaCO_3$	7·32	·013	...	...	...	...	...	·014	5248
Dark brown...	Very fine sandy loam	6·41	·027	·458	·045	·020	·011	·019	·008	5275
Yellow brown	Coarse sand ...	6·50	·015	·379	·048	·061	·014	...	·004	5153
Do. ...	do. ...	5·93	·015	·224	·065	·015	·016	...	·003	5154
Bright yellow-brown	Coarse, very sandy loam	5·01	·011	...	·088	·015	·019	...	·004	5155
Do.	do. do.	4·74	·008	...	...	...	...	...	·004	5156
Do.	do. do.	5·33	·008	...	...	...	...	...	·005	5157
Yellow-brown	Coarse sand ...	5·87	·013	...	·196	·027	·013	...	...	5299
Do. ...	do. ...	5·70	·010	...	·044	·043	·019	...	...	5300
Bright yellow-brown	Coarse, very sandy loam	6·61	·007	...	·227	·042	·151	·017	·008	5301
Do.	do. do.	6·37	...	...	...	...	...	...	...	5302
Do.	do. do.	6·74	...	...	...	...	...	...	...	5303
Do.	do. do.	6·59	...	...	...	...	...	...	...	5304
Pale brown ...	Sandy	6·08	·034	...	·058	·083	·034	·021	·005	5565
Yellow-brown	Very sandy loam	5·02	·028	...	·051	·041	·018	·026	·007	5566
Do. ...	do. ...	4·73	·031	...	·037	·065	·189	·036	·013	5567

Analysts: B. L. Southern, F. W. Steel, F. F. Allsop.

APPENDIX IV.

TABLE 2.

DARTMOOR SOILS—SIEVING TESTS OF COARSE AND FINE SAND FRACTIONS.

Type	1A.					1B.				1C.					1D.				
Loc. No.	Loc. 9159.					Loc. 9211.				Loc. 9201.					Loc. 9202.				
Lab. No.	5560.	5561.	5562.	5563.	5564.	5611.	5612.	5613.	5614.	5305.	5306.	5307.	5308.	5309.	5615.	5616.	5617.	5618.	5619.
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Coarser Sand — On 20-mesh	1·7	1·6	1·7	2·4	2·9	0·8	0·6	0·9	0·7	3·9	5·8	4·5	4·6	13·4	13·2	14·6	13·9	13·3	11·8
,, 30 ,,	8·8	8·8	8·5	7·3	7·0	4·5	4·1	2·9	2·7	6·8	7·5	6·2	5·7	7·3	13·7	14·1	11·9	10·9	10·0
,, 60 ,,	55·6	50·6	45·6	35·1	34·0	44·3	38·5	30·4	24·4	35·1	37·2	31·1	28·5	25·9	27·5	26·3	25·3	22·6	20·5
,, 80 ,,	7·0	7·2	6·6	7·0	7·3	10·0	9·1	8·6	6·2	8·3	6·8	6·5	6·9	6·2	6·1	5·6	5·8	6·2	5·1
Finer sand ,, 100 ,,	2·2	2·5	2·7	3·1	3·1	3·5	3·6	3·3	2·2	2·1	2·2	2·4	2·6	2·1	2·7	2·6	2·7	2·6	2·1
,, 120 ,,	2·1	1·8	2·1	2·4	2·0	3·1	2·6	2·6	2·6	2·6	1·9	2·3	2·2	2·1	1·8	2·4	2·4	2·8	2·0
< 120 ,,	11·2	13·9	13·9	19·6	20·0	15·7	15·8	15·3	10·1	15·6	12·5	15·2	15·2	15·4	15·7	14·5	16·7	17·3	16·2

Type	1E.						2A.				2B.				1A.
Loc. No.	Loc. 9104.						Loc. 5204.				Loc. 5198.				Loc.8772
Lab. No.	5145.	5146.	5147.	5148.	5149.	5150.	5648.	5649.	5650.	5651.	5245.	5246.	5247.	5248.	5275,
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Coarser sand — On 20-mesh	4·2	6·4	3·7	6·4	7·0	11·1	0·5	0·5	1·0	3·5	0·5	0·6	0·4	0·8	0·6
,, 30 ,,	13·3	14·7	10·0	10·2	8·6	12·3	1·8	1·9	1·7	2·6	2·7	2·6	2·1	2·7	1·8
,, 60 ,,	46·4	47·0	40·3	41·0	40·7	40·4	41·7	38·8	34·6	34·8	44·0	39·4	32·6	29·9	28·7
,, 80 ,,	6·3	5·4	7·7	6·6	6·8	6·6	17·8	16·7	16·0	13·8	14·2	15·7	17·2	13·5	20·0
Finer sand ,, 100 ,,	1·7	1·5	2·3	2·4	2·4	2·5	5·1	5·2	5·2	4·5	4·3	4·7	3·6	4·6	9·3
,, 120 ,,	1·7	1·5	1·8	2·2	2·1	2·1	3·8	3·5	3·3	3·2	4·8	3·7	4·4	3·2	6·2
< 120 ,,	12·1	10·4	17·4	14·9	16·8	17·2	16·3	17·7	19·3	15·4	17·3	19·2	22·4	21·0	22·8

Type	3A.					3A.						3B.			Wongan Hills		
Loc. No.	North of Loc. 5207.					Loc. 9204.						Loc. 9170.			Standard Light		
Lab. No.	5153.	5154.	5155.	5156.	5157.	5299.	5300.	5301.	5302.	5303.	5304.	5565.	5566.	5567.	Land Soils.		
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Coarser sand — On 20-mesh	6·4	7·6	7·4	8·7	9·7	8·4	5·8	7·9	11·0	10·6	11·9	6·0	5·7	5·6	17·7	10·9	11·5
,, 30 ,,	17·8	18·2	18·8	12·9	11·4	16·2	11·8	10·8	9·8	6·8	6·5	11·0	8·8	8·1	14·8	12·0	10·9
,, 60 ,,	35·8	35·3	31·9	29·1	27·4	40·1	37·1	33·0	26·8	24·3	21·5	36·8	32·7	28·9	28·4	25·8	23·7
,, 80 ,,	7·7	8·5	8·2	9·4	9·2	10·2	11·1	11·5	11·5	11·6	10·2	11·2	11·2	11·5	7·7	8·0	7·0
Finer sand ,, 100 ,,	4·0	3·0	3·5	5·0	5·9	2·8	4·3	4·2	4·5	4·7	5·1	5·1	4·7	4·6	3·1	3·7	3·1
,, 120 ,,	2·9	3·5	3·5	3·9	4·0	3·7	4·3	4·0	5·1	5·0	5·2	3·6	4·1	4·2	2·9	2·6	2·4
< 120 ,,	18·2	16·8	18·9	22·9	25·5	13·2	19·1	21·9	23·8	29·2	31·1	17·3	21·7	25·0	18·4	17·9	17·4

N.B.—The 80-mesh fraction in this table includes both coarse and fine sand; a 70-mesh screen being the standard sieve for separating these two fractions.

Analyst: B. L. Southern.

APPENDIX IV.

TABLE 3.

DARTMOOR SOILS -RATIOS BETWEEN CERTAIN MAJOR SAND FRACTIONS.

(Calculated from Tables 1 and 2.)

Lab. No.	Type.	Ratio of Percentages.	
		Coarse sand to Fine sand.	−30 + 60 sand to Whole sand.
5560	1A	3·85	62·8
5561	„	3·06	58·6
5562	„	2·77	56·2
5563	„	1·77	45·6
5564	„	1·82	44·5
5611	1B	1·99	54·1
5612	„	1·85	51·8
5613	„	1·58	47·5
5614	„	1·80	49·9
5305	1C	2·09	47·2
5306	„	2·76	50·3
5307	„	1·97	45·6
5308	„	1·88	43·4
5309	„	2·27	35·8
5615	1D	2·47	34·1
5616	„	2·56	32·8
5617	„	2·19	32·1
5618	„	1·94	29·8
5619	„	1·99	30·3
5145	1E	3·42	54·1
5146	„	4·13	54·1
5147	„	2·24	48·4
5148	„	2·46	49·0
5149	„	2·69	48·2
5150	„	2·52	43·8
5648	2A	1·69	47·9
5649	„	1·60	46·0
5650	„	1·31	42·7
5651	„	1·72	44·7
5245	2B	1·56	50·1
5246	„	1·34	45·8
5247	„	1·08	39·4
5248	„	1·13	39·5
5153	3A	2·15	38·5
5154	„	2·27	38·4
5155	„	1·99	34·6
5156	„	1·46	31·7
5157	„	1·28	29·4
5299	3A	2·69	42·4
5300	„	1·72	39·7
5301	„	1·56	35·3
5302	„	1·38	29·0
5303	„	1·10	26·3
5304	„	1·02	23·5
5565	3B	2·05	40·4
5566	„	1·50	36·8
5567	„	1·23	32·9
Wongan Hills sand heath soils from Experiment Farm	...	2·30	30·5
		1·87	31·9
		1·88	31·2
Averages—			
Dartmoor	...	2·02	41·8
Wongan Hills	...	2·02	31·2

APPENDIX IV.

TABLE 4.

DARTMOOR SOILS.—ADDITIONAL PARTIAL CHEMICAL ANALYSES.

Type ...	1A.				1A.		1A.					
Site ...	Loc. 5198 (Site 18).				Loc. 5198 (Site 19).		Loc. 5199 (Site 22).					
Lab. No.	708.	709.	710.	711.	712.	713.	714.	715	716.	717.	718.	719.
Depth (inches)	0–10	10–30	30–52	52–76	42–60	76–90	0–4	4–10	10–30	30–42	42–66	66–116
Colour (wet)...	Brown ...	Pale brown	Pale brown	Pale brown	Pale red brown	Pale pinky brown	Dark brown	Red-brown	Light brown	Pale brown	Pale pinky-brown	Pale pinky-brown
Nature ...	Very fine sandy loam	Very fine sandy loam	Very fine calcareous loam	Very fine calcareous loam	Very fine calcareous loam	Very fine calcareous loam	Fine sand	Fine sand	Fine sandy loam	Fine sandy loam	Very fine calcareous loam	Very fine calcareous loam
Reaction pH	8·38	8·11	8·11	8·31	8·31	8·14	7·92	7·99	8·09	8·13	8·11	8·06
Stones (%) ...	...	6	6	6	...	8	...	...	...	...	...	...
Calcium carbonate (%)...		Increasing	with depth.			ditto.	1·44	1·44	4·39	11·42	19·81	21·85
Magnesium carbonate (%)...	...	...	...	...	...	...	·70	·91	·97	1·58	2·27	4·44

Type ...	1B.					1B.					
Site ...	Loc. 5195 (Site 7).					Loc. 9211 (Site 10).					
Lab. No. ...	684.	685.	686.	687.	688.	689.	690.	691.	692.	693.	694.
Depth (inches)	0—5	5–9	16—36	36–47	at 47	0–2	2—9	9–12	12–29	29—60	60–106
Colour (wet)...	Dark red-brown	Dark red-brown	Dark red-brown	Dark red-brown	Dark red-brown	Dark red-brown	Dark red-brown.	Red-brown	Brown ...	Light brown	Light brown
Nature ...	Sand ...	Very sandy loam	Sandy loam	Sandy loam	Sandy loam	Very sandy loam	Very sandy loam	Sandy loam	Loam ...	Calc. loam	Calc. clay loam
Reaction pH	7·03	6·86	7·37	7·55	7·84	8·08	8·29	8·29	8·26	7·96	7·96
Stones (%) ...	...	...	...	...	21 (hard), $CaCO_3$	...	...	...	...	12	16
Calcium carbonate (%)...	...	...	...	...		Trace	increasing	with	depth.		
Magnesium carbonate (%)...	...	...	...	...	...	...	...	...	...	...	

APPENDIX IV., TABLE 4—*continued.*

Type	1C.				1D.			
Site	Loc. 5194 (Site 17).				Loc. 9194 (Site 15).			
Lab. No.	704.	705.	706.	707.	699.	700.	701.	702.
Depth	0—8	8—18	18—30	30—60	0—3	3—9	9—23	23—35
Colour (wet)	Dark red-brown	Red-brown	Light brown	Light brown	Dark red-brown	Dark red-brown	Red-brown	Red-brown
Nature	Fine sandy loam	Loam	Calc. loam	Calc. loam	Sandy loam	Sandy loam	Sandy loam	Sandy loam
Reaction, pH	7·79	8·13	7·96	7·86	5·83	4·59	4·84	7·55
Stones (%)	...	...	8	21	...	...	...	7
Calcium carbonate (%)	Increasing with depth.				...	Absent	...	Present

Type	1E.					1E.				
Site	Boundary 9145-6 (Site 2).					Loc. 9157 (Site 3).				
Lab. No.	669.	670.	671.	672.	673.	674.	675.	676.	677.	678.
Depth (inches)	0—4	4—12	12—30	30—60	60—116	0—2½	2½—9	12—30	30—60	60—116
Colour (wet)	Light brown	Light brown	Light red-brown	Light red-brown	Red-brown	Light brown	Light red-brown	Red-brown	Red-brown	Red-brown
Nature	Very sandy	Very sandy	Very sandy	Very sandy loam	Very sandy loam	Very sandy	Very sandy	Very sandy	Very sandy	Very sandy
Reaction, pH	6·30	4·72	4·50	4·94	6·07	5·85	5·16	5·39	5·85	6·86
Stones (%)	...	...	...	...	...	...	...	...	...	...
Calcium carbonate (%)	...	...	Absent	...	...	...	...	Absent	...	...

Type	1E.					1E.				1C.
Site	Loc. 9140 (Site 5).					Loc. 9195 (Site 14).				Loc. 9166.
Lab. No.	679.	680.	681.	682.	683.	695.	696.	697.	698.	703.*
Depth (inches)	0—1	1—9	9—30	30—60	60—116	0—3	3—10	10—30	30—42	0—12
Colour (wet)	Brown	Brown	Red-brown	Red-brown	Red brown	Red-brown	Red-brown	Red-brown	Red-brown	Light brown
Nature	Very sandy	Very sandy	Very sandy	Very sandy	Very sandy	Very sandy loam	Very sandy loam	Sandy loam	Sandy loam	Fine calc. clay
Reaction, pH	5·34	4·62	4·22	4·81	5·85	4·75	4·08	4·62	5·04	8·19
Stones (%)	...	...	...	...	...	...	...	...	...	...
Calcium carbonate (%)	...	...	Absent	...	...	...	Absent	...	...	Present

* Site 16: From "Crab-hole"; Contains also 0·015 per cent. of salt.

Analysts: B. L. Southern; F. W. Steel.

APPENDIX IV.

TABLE 5.

DARTMOOR SOILS—FIELD TESTS FOR REACTION AND WATER SOLUBLE SALTS.

Serial No.	Depth.	Reaction.	Soluble Salts.	Soil Texture.	Notes.
	inches.	pH.	%		
33	0—24	6·38	Trace	Reddish sand	Small rise—scrub and mallee
34	0—18	4·43	Trace	Brown sand	Scrub, jam, casuarina, etc.
	below 18	4·75	Trace	Red, brown sand	
35	0—7	8·19	0·75	Red-brown sandy loam	Salt bush and York gum in clay pan reserve
	7—16	7·38	0·41	Red-brown loam	
36	0—10	8·09	0·015	Red-brown loamy sand	Yorrel, centipede saltbush scrub
	10—20	8·55	0·056	Red-brown loam	
	20—30	8·23	0·33	Red-brown clay loam	
37	0—10	8·38	Trace	Brown fine sand (calcareous) ...	Yorrel, etc.
	10—20	8·17	0·056	do. do.	Loveland's farm
	20—28	8·14	0·17	Light brown calc. loam	
38	0—30	7·75	Trace	Red fine sand, probably wind blown	Mallee scrub and spinifex
39	0—2	8·29	Trace	Brown fine sand	York gum, grey centipede bush, salt bush
	2—16	8·36	0·01	do. do.	
	16—28	8·26	0·07	Brown fine loamy sand, calcareous	

With the exception of No. 37 these soils were all taken from the Wandalong Estate.

APPENDIX V.

TABLE 1.

WHEAT ANALYSES, DARTMOOR—1932 CROPS.

Variety.	Place Grown.	Moisture.	Nitrogen.	Protein A.†	Protein B.†
Bencubbin	Government Loc. 9104	9·61	1·79	10·43	10·38
Merredin	do. ...	10·89	1·73	10·08	10·18
Nabawa	do. ...	11·03	1·92	11·19	11·32
Noongaar	do. ...	9·97	1·69	9·85	9·84
Gluclub	Wandalong ...	9·80	2·15	12·53	12·50
Totadgin	do. ...	8·76	2·07	12·07	11·91
Nabawa*	do. ...	10·66	2·11	12·30	12·39
Noongaar	do. ...	11·14	1·90	11·08	11·22
Centenary	do. ...	10·56	2·10	12·24	12·30
Canberra	do. ...	10·83	2·07	12·07	12·18
Merredin*	do. ...	10·81	1·85	10·79	10·89
Gresley	do. ...	11·12	2·32	13·53	13·70
Bencubbin*	do. ...	10·66	2·09	12·19	12·28
Merredin (1930 crop) ...	do. ...	9·75	2·10	12·24	12·21
State F.A.Q. Wheat, 1932	... ...	11·00	1·74	10·14	10·25

* 150 points of rain fell in December on these wheats after they had ripened and before they could be harvested. Other varieties were stripped before this fall.

† Nitrogen x 5·83. A. is protein content of wheat in natural condition; B. protein calculated to uniform moisture basis of 10·0 per cent.

APPENDIX V.

TABLE 2.

MILLING TESTS AND ANALYSES OF DARTMOOR WHEATS, 1932 CROP.

Description.			Grain Analysis.			Milling Results.			
Variety Plot.	Class.	Condition.	Moisture.	Bushel Weight.	Weight of 1,000 grains.	Ease of Milling.	Flour.	Bran.	Pollard.
			%	lbs.	grams.		%	%	%
Merredin Government	Strong ...	Clean	10·2	63⅞	36·1	hard	71·5	19·7	8·8
Merredin Wandalong	Strong ...	Clean	11·2	64	37·6	hard	71·5	19·7	8·8
Gluclub Wandalong	Soft weak	Clean	10·3	63½	31·6	easy	69·2	21·1	9·7
Bencubbin Government	Medium strong	Clean	9·3	63⅜	42·8	hard	71·8	19·8	8·4
Bencubbin Wandalong	Medium strong	Clean	11·0	58¼	42·6	hard	72·2	19·5	8·3
F.A.Q., 1932-33 ...	...	...	11·0	63	38·8	easy	71·0	19·6	9·4

APPENDIX V., Table 2—*continued.*

Description.			Wholemeal Analysis.			Flour Analysis.					
Variety Plot.	Class.	Condition.	Protein* N x 5·83	Pelshenke test. Time.	Pelshenke test. Quality.	Moisture.	Absorption.†	Maltose figure.	Buffer index.	Colour Pekar Mean of 3.	Petrol Extract. ‡
			%	min.		%	%	%			
Merredin Government	Strong ...	Clean	10·3	150	14·9	12·5	55·8	1·58	1·5	4·8	6·0
Merredin Wandalong	Strong ...	Clean	11·2	140	12·8	12·0	55·5	1·65	1·6	4·8	8·0
Gluclub Wandalong	Soft weak	Clean	13·1	152	11·9	11·8	51·5	1·07	1·6	4·8	6·0
Bencubbin Government	Medium strong	Clean	10·3	148	14·7	12·2	54·6	1·55	1·7	4·7	10·0
Bencubbin Wandalong	Medium strong	Clean	12·7	148	11·9	11·5	54·7	1·31	0·9	4·5	7·0
F.A.Q., 1932-33 ...	...	...	10·25	150	15·0	12·8	53·0	1·46	1·5	5·0	7·0

* The wheat protein figure is calculated to a standard moisture basis of 10·0 per cent.

† The flour absorption figure and maltose calculated to standard moisture basis of 12·0 per cent.

‡ Kent Jones' method.

Analyst: R. G. Lapsley.

THE STORAGE OF POTATOES.

W. E. Collins, Potato Branch.

There is very little data on the storage of potatoes in this State, and reference has had to be made to the methods obtaining in other countries. Hitherto, the necessity had not arisen for a close study of this phase, by reason of the almost continuous movement of this commodity, but, due to the ever increasing growth of the industry, the time is considered opportune to give some attention to this very vital subject.

The object in the storage of potatoes is that of prolonging its edible quality throughout a longer period of time, thereby enabling the grower or the merchant to dispose of the crop at such time as the requirements of the trade demand, and by so doing avoid marketing it when there is an over supply and consequently low prices.

Growers have held seed potatoes in sound condition throughout the hot months of November, December, and January by means of cool airy sheds, and under shady trees, but ware potatoes intended for domestic use require somewhat different treatment. For instance, potatoes intended for seed must have light, whereas potatoes stored for future consumption must be kept from the light.

Light has a curious effect on potatoes. Solanum is developed, and the skin and the flesh of the tubers turn green—the longer the exposure the deeper the green. This greening is effected to the very centre of the potato, and is not confined to the surface layer of the flesh. In this green condition the tubers are bitter to the taste and actually poisonous—in fact, stock have died through eating greened potatoes to which they have had accidental access.

The type of storage to which consideration will be given in the ensuing article is that of pitting. Strictly speaking the term pitting is somewhat misleading, since it does not necessarily imply an actual pit in the ground, as will be noted in

the accompanying self-explanatory illustrations. It is a cheap form of storage, and when sound potatoes are pitted in this manner there is practically no risk involved, as they are almost certain to come out in good condition when required.

It would appear that the successful storage of potatoes is dependent upon a number of factors, among which may be mentioned drainage, ventilation, soundness of tubers stored and freedom from dirt and moisture.

In the pitting of potatoes, drainage is the first essential to be aimed at. The land must either be well drained naturally, or else so situated as to make good drainage possible.

Adequate ventilation of the pit is of supreme importance in maintaining the tubers in a sound and healthy condition. The temperature of storage for domestic use should be 45 degrees F. or as near this figure as is possible. When potatoes are first pitted every effort should be made to reduce the temperature quickly. This is particularly desirable if the weather is warm when they are dug, as they absorb heat rapidly, and also develop heat rapidly when stored in bulk. In natural storage this is most easily accomplished by the prompt attention to ventilation and

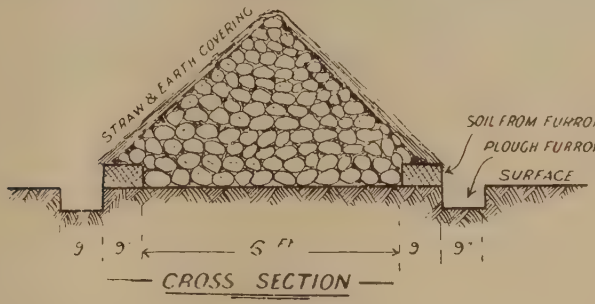
Cross-section of potato pit.
English method.

insulation of the pit. A good practice is to construct a small ventilation shaft of six to eight inches square out of inch timber. Bore numerous holes an inch or so in diameter in the lower portion of the shaft, and insert it in the centre of the pit as the tubers are being pitted. It should extend two or three feet above the tubers, so that when the final covering is applied it will protrude 12 to 18 inches above the ridge. The ventilator should be provided with a cap to prevent the entrance of rain. If the pit is more than ten feet in length a second ventilator should be inserted. A proved rule to follow is to have a ventilator every eight feet. This assures reasonably good ventilation of all portions of the pile. It would be as well if the grower occasionally lowered a thermometer down one of the shafts and tested the heat of his pit.

Soundness of tubers stored.—One of the most prolific sources of loss in storage is that resulting from the storage of unsound tubers. Unsound tubers may be classified under two heads:—those that are mechanically injured, such as bruised or forked potatoes, and those that are infected with disease, such as Late Blight. Ordinarily the Late Blight has been our most serious storage trouble, and in districts where this disease is likely to be prevalent, it should be so controlled by the thorough spraying of the growing plants as to effectually prevent tuber infection.

The presence of cut and bruised surfaces offer an easy point of infection for a number of storage decay organisms; therefore, the more carefully that potatoes are harvested and stored, the better will be their keeping qualities, and the less the shrinkage.

Freedom from soil and moisture.—Whilst it is recognised that it is not always possible to harvest the potato in such condition as to ensure freedom from any unusual amount of soil it is believed that, in so far as it is consistent with the safety of the crop, harvesting operations should be so timed as to ensure a minimum amount of soil adhering to the potatoes. It is not good practice, if obliged to dig the crop when the soil is too wet, for good results to gather the tubers as soon as they are dug. Advantage should be taken of every opportunity to leave them exposed to the sun and wind for an hour or more in order to allow the excess moisture to dry off, and to get rid of as much dirt as possible. When potatoes are stored with large quantities of moist soil adhering to the tubers, they are almost certain to develop a considerable amount of heat, especially if stored in bulk. It requires very little imagination on the part of any thinking grower to figure out that the potatoes stored under such conditions are much more likely to decay; and if no decay does occur, to realise that when tubers are subjected to such high temperatures, sprouting is induced and the chance of losses is very greatly increased. Let us not forget then that dirt and moisture are undesirable factors in potato storage, and make every effort to store clean and dry potatoes.



Potato Pit.

Victorian.

A simple method of making a pit as practised in Victoria is to turn up by plough or spade two furrows parallel to each other with a space of eight feet between them (inside measurement). Let it be in an East-West direction, so avoiding the direct rays of the sun on either side. The empty furrow space of course being on the outside of the pit, acts as a drain, and provision should be made for the escape of water from it. The upturned sods form the side of the pit and keep the potatoes together, the ends may be made either square by stacking or rounded off. Build up the pile as steeply as possible, this to shed the rain, and as soon as the potatoes are in position they should be immediately covered with a sufficient quantity of straw, hay, rushes, or other straight litter to exclude light; a thin layer of soil may be added to within a foot of the ridge, this to retain the covering in position. The pitted potatoes should be left in this condition as long as they are safe from heavy soaking rains. This gives them a chance to go through the sweating process and get thoroughly cooled off, a most important point. After which there is little danger from heating and sweating when the final covering is applied in from two to three weeks time.

In this final operation you will be insulating against heat, and not cold or frost. Most other countries have to protect against freezing, but this latter holds out no difficulties in this State. Our problem is to keep the stored potatoes cool, and every effort should be made to bring this about, even if one has to make a light awning from old bags and suspend same on stakes to break the heat of the mid-day sun. This will well repay the trouble taken. Cold conditions inhibit sprouting, arrest decay, and if the potatoes are infested with potato moth larva no damage need be apprehended from a re-infestation. So, if the covering is brought up to eight inches or so in thickness, inclusive of a moderately even layer of soil, all should be well.

For conclusion it may be quoted that at Osborne Park where a grower requires his land urgently for a rotation crop of another vegetable, the potatoes are dug and successful storage is obtained for short periods by this system of pitting. Again, a grower at Young's Siding has experimented in this direction for the past three seasons and claims to have held potatoes in excellent condition for a period of three to three and a half months.

It may also be assumed that there are many other growers who have a knowledge and have even practised the storage of potatoes, but it is not the purpose of this article to advocate the general storage of this commodity. Main crops are being dug from October to the following May, and to have a carry over from the first diggings would hamper rather than help the industry. Rather is it written for those harvesting their crops from March onwards. From an inspection point of view it is in this latter part of the season that potatoes come forward greened, wilted, and showing every evidence of bad storage conditions, when, if only some part of the crop had been stored under the method outlined, a much more marketable article would have been the case, giving satisfaction both to the trade and the consumer.

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RABBIT BAITS AND STOCK POISONING.

A. Arnold, Chief Inspector of Rabbits.

On account of the large losses of stock last year owing to the prevalence of toxic paralysis, many settlers, especially those in the inner areas, are inclined to the opinion that the stock died, not from toxic paralysis, but from picking up and eating old phosphorised pollard rabbit baits.

The baits would certainly be poisonous to all classes of stock if picked up shortly after being laid. It has, however, to be realised that the phosphorous in the bait becomes oxidised, and therefore less and less poisonous with the passage of time, until at last it is quite harmless. With normal baits this condition is reached in about seven days.

It is largely because of this change in the action of the phosphorous that has caused this class of bait to be so universally used throughout the whole of Australia. It means that baits can be laid in a wholesale way over a large tract

of country and, as in the course of a few days such baits are rendered innocuous, stock may be returned to the paddock without any harmful results, and there is no need for the farmer to pick up the baits, which would be the case if strychnine or arsenic baits had been employed. These baits would remain poisonous for all time.

Some years ago Dr. Stoward conducted some experiments with ordinary phosphorised pollard baits during the middle of summer, and found that such baits were innocuous after being laid two days.

Recently an investigation was conducted regarding some sheep losses in the Beverley district when a few sheep died after being placed in a paddock which had been previously poisoned with phosphorised baits and it was thought death was due to picking up of such baits. Some of the baits were brought to Perth and analysed and were found to contain a small percentage of free phosphorus, so small in fact that a sheep would require to take 1,000 of these baits in order to receive a toxic dose.

However, with a view to definitely determining the toxicity of normal baits after being laid seven days, a definite experiment, under the control of Dr. Bennetts, was carried out by the department during April of last year. This is rather a cool period of the year when baits would be liable to remain poisonous for a longer period than in the summer. The baits were the ordinary sized baits as laid by a poison cart, being three-quarters of an inch long and as thick as a lead pencil. They were left in the paddock for seven days as recommended by the department and then forwarded by post in air tight tins and fed to rabbits as follows:—

1. Batch No. 1, laid 4/4/33, picked up 11/4/33—

   Rabbit No. 1—

   On 12/4/33 fed 6 baits.

   On 13/4/33 fed 12 baits.

   On 19/4/33 fed 7 baits.

Baits were stored in air-tight containers until fed. All baits were eaten. The rabbit showed no sign of illness.

2. Batch No. 2, laid 4/4/33, picked up 13/4/33—

   Rabbit No. 2—

   On 19/4/33 fed 12 baits.

   On 20/4/33 fed 12 baits.

All eaten. The rabbit showed no sign of illness.

An enormous number of phosphorised baits are laid in the outer districts of the Eastern Wheat Belt; in fact, more are laid in that area than in any other portion of the State. This has been going on for a number of years yet one rarely hears or receives reports of loss of stock due to poison baits from these areas. Where, however, rabbits, have only recently become numerous, necessitating poison being laid, settlers are very dubious, and if any stock die, no matter from what cause, death is invariably attributed to the stock having taken a poison bait, where of course, such has been laid. Numerous investigations by veterinary and other departmental officers, however, have shown death to have been due to other causes, mainly toxic paralysis.

It is interesting to record that prior to the laying of rabbit poison, when stock died from unknown causes it was invariably attributed to the chewing of bones of game, etc., that had been poisoned with strychnine for dogs, and it was then claimed that such stock died from strychnine poisoning. This is now generally recognised as erroneous and is on all fours with the contention that the loss of stock is due to their eating rabbit baits.

It should be remembered, however, that it is most important and necessary to adhere to the directions when mixing baits; the proper amount of water to allow for the gradual oxidation of the phosphorus is specified. Many depart from the prescribed formula, in some cases to advantage. It is generally known that rabbits are fond of a sweetened bait and all formulae provide for this, and to this end extra molasses is at times added to that already in the tin. Such a bait will certainly be more readily taken, but when this is done less water is required for the mixing, resulting in a heavier form of liquid being mixed with the pollard. This materially retards oxidation of the phosphorous and such baits would remain poisonous for a much longer period. If the pollard were mixed wholly with molasses it can easily be seen that the bait will remain poisonous for a very long time indeed.

A farmer reported that during the last five years he poisoned according to directions and placed sheep in the poisoned paddocks 10 days after laying the baits without ever having had any losses. He was recently advised by a neighbour that the baits would be more attractive if additional molasses were added. He found this correct and subsequently turned his sheep into the paddock as previously and lost a number, the symptoms indicating phosphorous poisoning.

In some cases, also, it is the custom to mix the poison at double strength. It can easily be seen that such baits will retain more free phosphorous and thus remain poisonous for a considerable period and be more harmful than if properly mixed. A normal bait freshly laid contains .045 grains of phosphorous; the toxic dose of phosphorous for a sheep is 2 grains thus a sheep would have to ingest 45 freshly laid baits in order to obtain a toxic dose.

Another frequent departure from the directions is the omission of the bran (three parts pollard and one part bran is recommended). The main reason for the addition of the bran is to cause the better disintegration of the bait, and when pollard only is used, free oxidation of the phosphorous is retarded. Some pollard is of a coarse nature, other again is fine like flour. This latter has a tendency to form a hard coating on the outer surface which delays oxidation to a certain extent. The addition of the bran effectively overcomes this tendency, hence the utmost importance to adhere to directions.

With the exposure of the bait the phosphorous oxidises with the passing of time, rendering the baits less and less poisonous and the department's recommendation is to keep sheep out of poisoned paddocks for at least a week or ten days during the summer, and changing weather conditions might even lengthen this period.

It can therefore be seen that at the expiration of a week or fortnight, an enormous number of baits would need to be ingested to cause any harmful results. In fact, numerous trials of baits mixed in accord with directions and laid in the field for a week have been undertaken without any harmful results when fed to rabbits, but if directions are not followed or the formula added to in any way, conditions would naturally be altered.

FOLIAGE BAITING AND TRAPPING FOR THE CONTROL OF FRUIT FLY.

By L. J. Newman,
Government Entomologist.

The following are recommended as suitable foliage baits and trapping lures for the control of fruit fly.

Juice of one dozen ripe oranges or mandarins (windfalls will do)—
4 lbs. of molasses or treacle;
5 ozs. paste arsenate of lead or 2½ ozs. powder arsenate of lead;
Water to make four gallons.

Method of making.—Squeeze out the juice of the oranges into a kerosene tin or other vessel. Dissolve the molasses or treacle in one gallon of water, then add the fruit juice. To this add the arsenate of lead, reduced by the addition of water to the consistency of milk. Mix the ingredients thoroughly, adding the required amount of water. When using keep well stirred.

Alternative Formula.—When it is impossible to obtain orange or other citrus fruit juice, fruits in season or rock melon juice may be used. It has been proved that the best results follow the use of a bait giving off an orange aroma.

Boil 4 to 6 lbs. ripe fruit in one gallon of water until reduced to a pulp. Prolonged boiling only tends to weaken the aroma, and is otherwise of no advantage. When sufficiently soft, mash and strain off the liquid. Dissolve in one gallon of water 4 to 5 lbs. of molasses or treacle. Reduce 5 ozs. of paste arsenate of lead or 2½ ozs. powder arsenate of lead to the consistency of milk. Mix the three ingredients together thoroughly and add sufficient water to make four gallons.

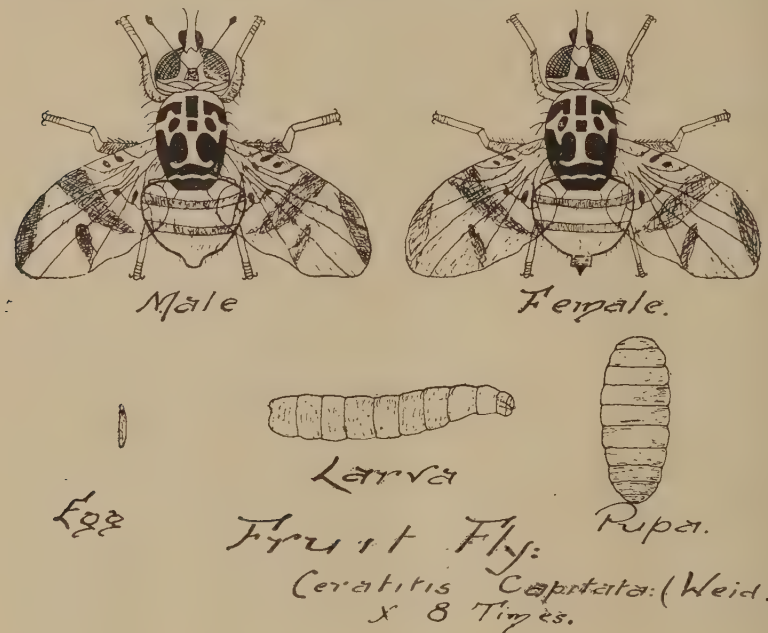
When using either formula, keep ingredients well stirred. Windfalls and maggot infested fruit may be used provided that the fruits have not fermented or gone mouldy. Only sufficient bait should be mixed for daily use. If the mixture is kept for more than 48 hours, fermentation will take place. The fermentation will produce acetic acid, which will have the effect of freeing the arsenic in the arsenate of lead, and thus injure the fruit and foliage. No fermentation takes place after the bait is applied to the foliage, but only when the combined solution is held in a vessel.

The first application of the bait should be made 7 to 8 weeks before the fruit is expected to ripen, and every 6 to 8 days thereafter until the fruit is stripped. When the fruit is stripped make two more applications of bait to the trees at intervals of 12 to 14 days. After heavy rain renew bait. In hot weather apply the bait more particularly to the undersides of the leaves in shady positions. In winter apply to the sunny sides of the trees, north and west, in equal quantities to upper and under sides of foliage.

In distributing the bait avoid the fruit as far as possible.

An effective bait is made, by replacing the arsenate of lead, with 1½ oz. of arsenate of soda to each gallon. This, owing to its foliage burning qualities, should not be applied direct to the tree. The method adopted is to apply it to bunches of eucalyptus or other suitable foliage and hang in the fruit trees, seeing that it does not come in contact with the fruit or leaves.

Small bags of bran, soaked in this solution and suspended in the trees, will keep moist for a considerable time and act as effective poisonous lures.



TRAPPING OR LURING.

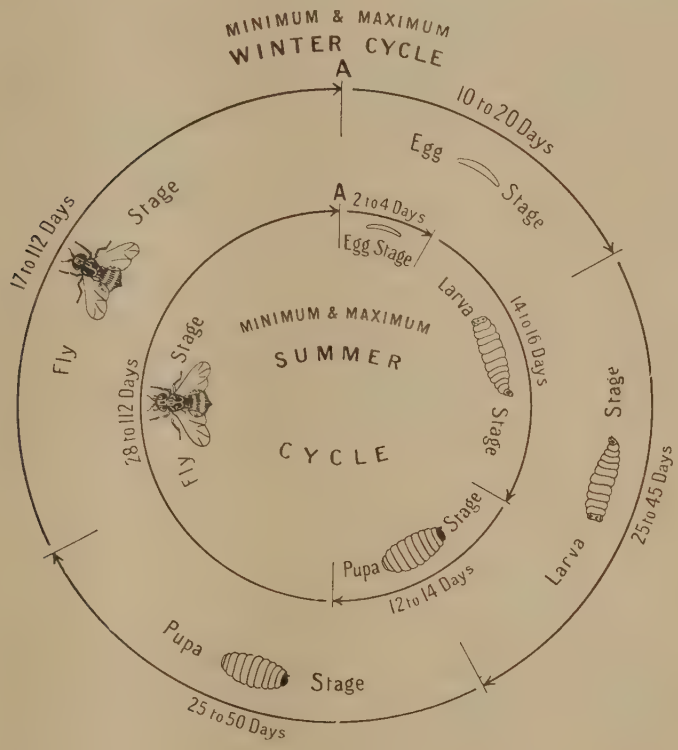
Pollard and Borax Mixture.—8 ozs. pollard, 6 ozs. powdered borax, 1 gallon of water.

Mix thoroughly and steep overnight, again shake or mix well and allow to settle. Draw or syphon off the clear amber coloured liquid discarding the residue, which should be buried. If desired, ½ oz. of arsenate of soda may be added to each gallon of the lure.

Clensel Lure.—One part of clensel to 30 parts of water.

A locally made insecticide, under the name of "Beeco," has given equally good luring results, and is recommended at a strength of 1 part to 40 parts of water.

These lures should be used in ½ pint lever lid tins or in glass jars. These should be half filled with the luring medium. Renew lure every 7 to 10 days or whenever traps have, from any cause, dried out. At least two traps per tree should be used, the more the better. Luring or trapping is recommended for gardens containing up to 200 trees. In larger orchards, they should be employed as indicators and when flies are captured, the foliage bait should be applied.



Traps can also be used to great advantage throughout the winter and spring months to capture the over-wintering fruit flies.

Take every advantage throughout the winter and spring to destroy the fruit fly, realising that these are the progenitors of the summer and autumn swarms. One pair of fruit flies then got rid of, are worth thousands captured or poisoned later on. It is far easier to control this pest during its minimum period, than when at its maximum.

Pick all maggot infested fruit from trees and ground daily and destroy same by boiling.

THE BDELLID MITE.

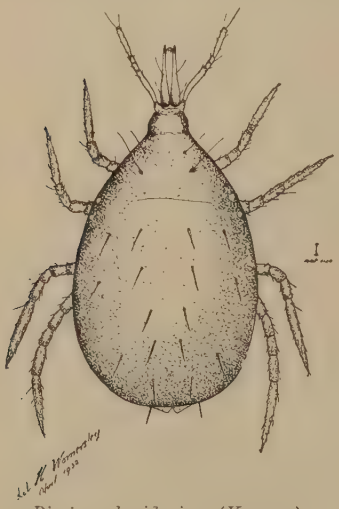
L. J. Newman, Government Entomologist.

The Bdellid Mite (*biscirus lapidarius*), a predatory parasite of the Lucerne Flea (*Smynthuris viridis*), was discovered at Waroona during July, 1931, by Mr. H. Womersley, Entomologist of the Entomological Branch of the Council of Scientific and Industrial Research. This was brought about by our attention being drawn by Mr. Weller, of Waroona, to the fact that the flea had been progressively decreasing in certain parts of his property.

Shortly after the finding at Waroona, it was observed at Denmark and Burekup. These areas, particularly Waroona, were kept under constant observation, to determine, if possible, what actual controlling value this mite had over the flea.

No attempt was made to spread the parasite during the winter of 1931, except that a colony was introduced into and established in the Insectary Grounds, Perth.

The observations made certainly indicated that the predator was worth following up the next winter. It must be understood that the Bdellid Mite, like its host the Lucerne Flea, is only active during the period from May to the end of September, except in very moist and cool locations, when the active period may extend to the middle or end of October. With the advent of dry and warm conditions, both host and parasite produce or lay over-summering or æstivating eggs. These remain dormant throughout the dry season, hatching out upon the advent of autumn rains. There is at most only an active period of six months.



Biscirus lapidarius (Kramer).
One of the Snout-mites (*Bdellidae*), predatory on the Clover Springtail (*Sminthurus viridis*).

During the winter of 1932, further field and laboratory studies of the Bdellid Mite were made. The results were still more encouraging, as it was proved that in the areas under observation the parasite had increased considerably, with a corresponding decrease of the pest.

To further test the proposition, colonies were collected and placed at Guildford, Cannington, Muresk Agricultural College and Denmark State Farm. In each instance the colonies so placed became established, with the exception of those placed at the State Farm, Denmark. This colony was destroyed as the result of a flood.

In the "Journal of Agriculture" of June, 1932, a short illustrated article describing the Bdellid Mite was published.

During the 1933 season the work of spreading this beneficial mite was further advanced. With the assistance of Mr. Currie, a senior entomologist of the Council of Science and Industry, a more intense survey of the position was undertaken and it was found that the predator was more widespread than was expected. As a matter of fact the surveys showed that the mite was to be found in many areas along the coastal plain between Perth and Bunbury and it was

widespread around the Northam, Muresk, York districts. It has also been found in the Chittering Brook and Chidlow districts and no doubt further surveys would reveal its presence in other areas.

This beneficial mite cannot be bred up in cages, but has to be collected in the fields, entailing considerable time and close work. To enable the collecting to be done as economically as possible, we have used small asperators and by means of these the mites are sucked up into tubes and distributed. During the months of July to September inclusive, colonies were supplied to 70 local applicants. Each colony contained 100 or more Bdellid Mites, a total of 7,000.

Colonies totalling 2,910 mites were forwarded to South Australia, 3,220 mites to Victoria and 2,420 mites to Tasmania, a grand total of 15,550 mites.

Owing to the advent of early warm dry weather in September, the predator and its host the flea were greatly reduced. This prevented any further distribution until next wet season.

It is too early yet to definitely state whether this predator will do equally well in all districts. To date, it appears most active in the moist flat plains of the coastal areas. In the Northam-York districts it has not yet become apparent in large numbers and consequently has not depressed the flea population to the same extent.

There appears to be little doubt that where it is found in numbers, this predator is a positive limiting factor of the flea.

Every effort has been made and is being continued, to assist in the spreading of this beneficial predatory mite. It has to be realised, however, that the nature of the work renders this distribution difficult and slow.

The work is still in the experimental stage as far as the adaptibility of the parasite to all areas where the flea is found.

GREEN TOMATO BUG.

Observations on the Bionomics of the Green Tomato Bug, Nezara viridula Linn, with remedial measures. Also a short account of the introduced egg parasite, Micro-phanurus megacephalus, Ashmead.

By L. J. Newman, F.R.E.S., Government Entomologist, and
B. A. O'Connor, B.A., B.Sc. Agr.

The Green Tomato Bug was first recorded in this State in the year 1920. It was found to be attacking tomatoes, potatoes, beans, and other vegetable and garden plants, around the port of Bunbury.

On the pest being discovered, prompt warnings were issued through the Press, advising the public of the potential powers of destruction possessed by this insect and the danger of allowing it to spread. Like many other warnings, it went unheeded, with the result that the Green Bug to-day is found all over the coastal and hills areas of the South-West and now constitutes a major problem. Once introduced into a district, it rapidly spreads, by means of its own powers of flight.

This bug was described by Linnaeus in Europe as far back as 1758. It is recorded from Europe, Asia, Africa, North America, India, New South Wales, Queensland and Western Australia. Like all the plant feeding bugs, it is a sap sucker.

The plants observed to be seriously attacked are beans, tomatoes, potatoes, egg plants, lucerne, maize, peas, cotton, silver beet, cabbage, cauliflower, rhubarb, pumpkin, rock melon, citrus fruits, pears, stone fruits, grapes, amaranthus, dahlias, celosias, cosmos and many other garden plants and shrubs. It is most cosmopolitan in its selection of food plants.

In 1926 an illustrated account of this bug was published and afterwards published as Leaflet No. 179.

In January, 1932, a further and more accurate study of the life history and habits of the bug in this State was commenced. This was considered desirable, because it might lead to an improvement in methods of control, of what has become one of our major insect problems and also because of the contemplated introduction of parasites from America and Egypt. Owing to the resignation of Mr. O'Connor the project was interrupted, so that the data presented is somewhat incomplete.

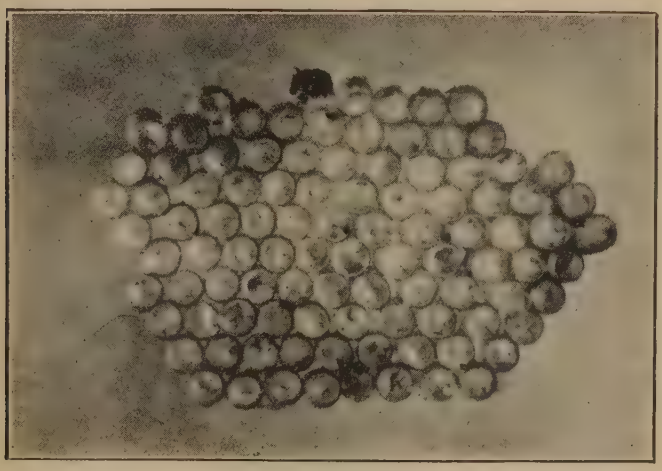
Breeding Technique.—Considerable difficulty was experienced in attempting to breed the bugs in a healthy condition and at the same time observe the life history of individuals. Egg laying was obtained by placing adult bugs on potted amaranthus, a favoured garden food plant, covered with a wire gauze cylinder. Attempts were then made to rear the young nymphs on growing plants, using bamboo cages to confine them as employed by Van der Merwe for the study of aphis leguminosa. This method proved unsuccessful, the nymphs dying in a few days. Finally, glass tubes six inches long and one inch in diameter were successfully used, the open ends being stopped with cotton wool and fresh food supplied daily. The bugs developed under these conditions, but they were not robust and the bulk of them died in attempting to cast the last nymphal skin. This trouble was probably due to the nature of the food, which consisted of stems and leaves, whereas under natural conditions the insect shows a decided taste for fruits. On the 24th April, 1932, numerous adults and fifth instar nymphs were placed in lantern glass jars with cheesecloth tops and fed on tomato fruits. They flourished well on this diet and at the end of July, a period of 10 weeks after being placed in the jars, most of them were still alive and healthy.

The tomato plant without the fruit is not a successful breeding medium. Several attempts were made at various times to breed third instar nymphs on growing tomato plants, with the result that they died within a very short time. This fact is very interesting, as the tomato crops are very severely damaged by this bug. It would appear that the bugs do not breed upon the young tomato plants, but invade the crop after the fruit has formed. This point has not been definitely decided by observations in the field.

On 5th September, 1932, eighteen pairs of bugs found copulating in the field were taken into the laboratory so that their copulation and oviposition could be observed. These were placed in cardboard boxes 3in. x 1¾in. by 1¼in., from which, with the exception of a marginal edge, the sides, top and bottom had been cut out. The sides and bottom were covered with cheese cloth and the top with cellophane which made very useful observation cages. A loose piece of blotting paper was placed in the bottom to absorb the excreta. Food was supplied daily. Small wire gauze cylinders 2in. deep x ¾in. wide and corked at one end, were used during experiments on the winter feeding of the bugs.

Eggs.—The eggs of the bugs, which are creamy coloured when laid, are cylindrical in shape and rounded at the bottom. They are deposited in clusters or rafts consisting of regular rows. The eggs are stuck to one another and to the leaf on which they are placed, by a colourless, glutinous substance. In almost every instance they are laid on the back or under surface of the leaves.

PLATE I.



Typical egg mass of Bug. Enlarged original.

The number of eggs in a cluster or raft varies from 30 up to as many as 87 and in odd instances as many as 100. The counting of 20 egg clusters gave the following number of eggs:—30, 38, 38, 44, 51, 53, 54, 54, 56, 60, 64, 68, 70, 70, 72, 73, 75, 76, 86, 87. Bugs in captivity were observed to lay as few as 10 eggs in a cluster and occasionally they were laid in twos and threes, or even singly.

On several occasions bugs confined on potted plants were observed to suck the eggs. This has also been noted in the field, the males being the culprits.

As the eggs develop, the colour changes from cream to yellow and then to orange red. At an early stage a red mark appears on the top of the egg and later the dark burster becomes visible. Finally the circular operculum or lid of the egg is pushed off by the action of the egg burster and the young nymph emerges.

The first eggs for 1932-33 season were found in the field on September 22nd. There were 70 eggs in the cluster, pale in colour and evidently just newly laid. These eggs did not hatch until October 11th, a period of 19 days. Eggs laid on potted plants in November hatched in 11-12 days, and those laid in February 5-7 days.

A point of considerable interest about the eggs laid in February was that of several clusters laid within a few days of one another, one cluster hatched in five days, another in six days, and a third in seven days. The duration of the first nymphal stage after emerging from the eggs was five, four, and three

days, so that the time from the laying of the eggs to the first moult was in each case 10 days, although the eggs hatched at various periods of from 5-7 days.

Nymphs.—The newly emerged nymphs in their first instar, are of a general yellowish red colour, with black markings, in the form of a band around the front and sides of the thorax and dots down the mid dorsal line of the abdomen and a white patch at each side of the base of the abdomen. The eyes are crimson. These colours quickly darken. Body length 1/16th inch.

These first instar bugs remain clustered on the empty egg mass until after the first moult, when they cease to be gregarious and scatter over the host plant. The period between the hatching and the first moult occupies from four to five days (November, January) and two to three days (March, May).

If the leaf to which the empty egg mass is attached is removed from the plant, the drying of its tissue causes these first instar bugs to migrate to moister surroundings.

PLATE II.

Second instar Bug. Enlarged. Frogg.

Second instar.—This state follows the first moult and occupies a period of six to 24 days (November, January), and 11 to 20 days (March, May). The bugs appear from this moult with head and thorax brown to black and two light spots on each side of the marginal edges of the thorax. The abdominal portion is reddish with a varying number of yellowish or whitish markings. Down the centre of the abdomen, are three lateral black markings, the marginal edge having a number of small white dots. Legs and antennae black, length ⅛in.

Third instar.—Follows the second moult and lasts from 10 to 29 days (November January), and 13 to 20 days (March, May). The head and thorax of the bug is then almost black, with a light marking or shading along the margins of the head and down the centre of the thorax. The abdomen is considerably darker than in the second instar and is marked with a regular pattern of yellowish or whitish spots, with three somewhat conspicuous markings down

the centre of the abdomen. Eyes dark reddish, legs, antennae and beak, brownish black, length 3/16th inch.

Fourth instar.—This follows the third moult and covers a period of 11 to 33 days (November, January), and 14 to 36 days (March, May). This stage varies considerably in colour and pattern. The light forms have the head and thorax pale green, with black markings, abdomen slightly darker than head and thorax, with a pattern of yellowish or whitish markings. The centre of the abdomen has three distinct dark areas, legs brownish.

PLATE III.

Fourth instar Bug with wing buds showing. (Original.) Enlarged 3 times.

PLATE IV.

Adult or Imago Stage. (Original.) Enlarged 3 times.

The dark form. Head black with two distinct yellow markings at the side Thorax black with orange-coloured marks along the side. Abdomen dark red or brown, central markings black, rest of abdomen marked with numerous yellowish spots. Antennae black, legs brownish black, length ¼ inch.

Fifth instar.—This follows the fourth moult and occupies 22 to 38 days (November, January), and 32 to 38 days (March, May). Like the fourth instar there is considerable variation in colour and markings.

In the light form the head, thorax, and wing buds are pale green with black margin and other black markings. Abdomen yellowish green, darker towards the centre with red areas surrounded with black. Numerous other spots of a yellowish colour, lateral margin of abdomen bordered with black. Antennae green, with terminal segments black, legs greenish brown. Eyes dark brown.

The dark form has head and thorax black. Margins of head and thorax with orange markings. Abdomen dark brown to almost black, with numerous white spots and pinkish margin. Antennae and legs almost black. Length about 2/5th inch.

Adult or Imago.—This appears after the fifth moult. The adult female is oblong in form, measuring on the average about 5/8th inch long. The male rarely exceeds half inch. The colour in a striking green on the dorsal or top side and a paler green on the ventral or under side. The head, thorax, and

elytra or wing covers, are densely covered with minute punctures. The antennae is pale green, merging into brown on the last two segments. The eyes are dark green. The legs are pale green. The rostrum or beak is light brownish in colour and is carried in a folded back position under the head and thorax. There is a total dissimilarity in colour and markings between the various pre-winged or nymphal stages of this bug. This great variation has led many growers astray in that they do not connect the varied coloured nymphs with the adult green bugs.

LIFE HISTORY.

Period. November, December, January, 1932.		Period. March, April, May, 1933.	
Egg stage ..	10—12 days	Egg stage ..	5—7 days
First instar ..	4—5 „	First instar ..	2—3 „
Second instar ..	6—24 „	Second instar ..	11—20 „
Third instar ..	10—29 „	Third instar ..	13—20 „
Fourth instar ..	11—33 „	Fourth instar ..	14—36 „
Fifth instar ..	22—38 „	Fifth instar ..	32—34 „
	77—120 days		83—141 days

Average period to adult, 98 days. Average period to adult, 97 days.

As the season advanced the periods in the life cycle shortened, and as the summer declined, the periods lengthened.

The figures for the fifth stadium were rather scanty as only four bugs reached the adult stage in the November-January period and two in the March-May period. However, the fifth stage in these six instances was fairly consistent, being 22, 34, 38, 34, 32, 27.

If the life history in the field corresponds roughly to that obtaining under laboratory conditions, there would not be more than three generations a year, as development during the winter months is considerably retarded.

Copulation.—The earliest record of copulation during the period of the investigation 1932-33 was July 29th, 1932. Several pairs of bugs had been taken in the field on July 25th and two of these pairs were observed in copulation on July 29th. On August 3rd and September 5th copulation was observed in the field. On September 5th, 18 pairs of bugs in copulation were taken in the field and placed in observation boxes and copulation took place during the following six weeks. These acts were separated by periods of from three to 20 days.

OVERWINTERING OF THE BUG.

Adults of Nezara viridula are found hiding away under bark, amongst garden litter or in other suitable sheltered positions during winter (May to August). The majority of these bugs turn a greenish chocolate brown and appear to be very sluggish and give the impression of completely hibernating until the following spring. It is our opinion, however, that these dark bugs gradually die off and that it is those which retain their green colour and come out at intervals of fine weather during the winter and feed, that carry through from autumn to

spring. Fifth instar bugs are also observed to be active during the fine winter days, and no doubt carry through to the spring, when the final moult takes place and they appear as early spring adults.

These nymphs when captured during the winter and fed in the laboratory, moult and become adults, showing that development is still proceeding during winter. Finally, experiments conducted in feeding the adult bugs during winter proved that those whose food was cut off die much more rapidly than those which are fed. The bugs which survive the winter appear to definitely require food during this period.

The adult bugs are capable of living for some months, and during this period may lay several rafts of eggs.

CHARACTER OF INJURY.

This bug is termed a Haustellate insect, or in common parlance, a sap sucker. The rostrum or beak is inserted into the foliage or fruit and the liquid juices sucked out. The effect on the foliage is to cause the leaves and young shoots to turn yellow, flag, and finally wither up.

PLATE V.

Peaches showing bugs in the act of sucking and the distorted effect produced. (Whitmarsh.)

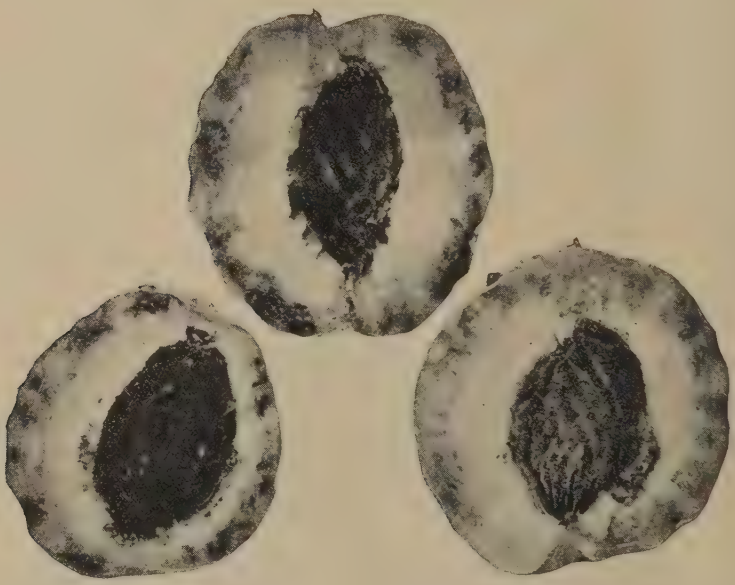
In the case of fruit, the portions which have been punctured appear to die, whilst the unpunctured portions continue to grow, and thus is produced the hard dry unevennesses so commonly found in fruit attacked. Fruit when cut, clearly shows the dead patches under the skin.

The keeping qualities and flavour of fruit are destroyed. Fruits badly damaged by this bug are rendered entirely unsaleable, and, even if only slightly affected, they become second grade.

Beans are a favourite host plant, the beans being sucked dry and rendered tough and useless. Tomato fruits exhibit a mottled appearance, and have in the flesh many dry and tough patches.

Many other fruits, vegetables and flowers are severely damaged by this bug.

PLATE VI.



Peaches cut open, depicting the damage caused by the bug to the tissue of the fruit. (Whitmarsh.)

CONTROL MEASURES.

Knowing that the eggs of this bug are laid in clusters on the under side of the foliage of the plant attacked, much good can be accomplished by picking off these egg masses and destroying them.

The habit of the young bugs when first emerged and up to the first moult, is to live and feed gregariously, so that they will always be found in clusters near or on the eggs from which they have hatched. They are more readily destroyed whilst in the pre-winged stage; therefore, every effort should be made to destroy them whilst they are sensitive to contact sprays. Once the adult winged stage is reached, it is a most difficult pest to destroy.

The bug is purely a sap sucker. It is, therefore, useless to apply poison dusts and sprays as for caterpillars. The only way a plant bug can be destroyed is by fumigation or contact spray. In general, fumigation is out of the question, owing to the cost of materials and labour involved.

PLATE VII.

White grapes depicting the shrivelling and drying-up of the fruit as the result of bug attack. (Original.)

In the use of contact sprays, it is very important to see that the pump used has sufficient power behind it to ensure that the spray is forced into the breathing spiracles, the mere wetting of the bugs with the spraying material is not sufficient.

To meet the difficulty occasioned by the presence of this pest, the grower must provide a suitable spraying outfit. Whatever style of pump is used, it should be fitted with three or four feet of extension pipe, a curved elbow, and a good nozzle.

The following sprays can be used with good effect:—

Phenyle 1 quart, washing soda 3 lbs., soap 2 lbs., water 40 gallons. Shred the soap and dissolve by boiling in two gallons water, add the other ingredients, and break down to the required strength by the addition of the balance of water.

Another useful formula is the following:—Soft soap or Sunlight soap 4 lbs., turpentine 1½ pints, water 20 gallons. Dissolve the soap in four gallons of boiling water, remove from fire and allow to cool off, but not get cold. Add the turps, stirring thoroughly, and make up to 20 gallons with water.

Carbolic Lifebuoy soap spray:—One cake of this soap to the gallon of water. Shred the soap and dissolve by boiling. Apply warm.

Concentrated clensel, a proprietary spray, used at a strength of one part to 60 parts water is effective, especially against the pre-winged stages.

Pysect, a ready to use pyrethrum spray, at one part to 100 parts water is also good.

Katakilla proprietary spray, at a strength of one packet to 2½ gallons of water, will destroy the bugs.

An effective spray is made with the following:—1½ cakes U.C.S. carbolic soap, half pint kerosene, and four gallons of water. Shred the soap and dissolve by boiling in two gallons of water. Remove from the fire and add the kerosene and thoroughly emulsify. Make up to four gallons with hot water.

Any spray containing a carbolic content should not be used on foliage or fruit about to be consumed, as it will impart an objectionable flavour.

Pyrethrum dust alone or pyrethrum dust mixed with an equal quantity of 2½ per cent. nicotine dust, applied with a dust gun, will destroy many of the bugs and also act for a time as a deterrent. The dust should be liberally applied to the infested plants and to any bugs which may fall to the ground.

All tomatoes should be grown on trellises or stakes. If allowed to grow on the ground, it is impossible to get in contact with the bugs, when using contact dusts or sprays.

Farm sanitation is an important factor in the control of this pest. All tomato, bean, or other plants which have ceased to be of value, should be pulled up and destroyed by fire. Keep down all weeds and litter. Avoid the practice of allowing the headlands and fence alignments to become overgrown with weeds, or covered with rubbish, as such conditions make excellent breeding grounds for the bug.

Keep a sharp lookout for the bug during the winter and early spring and destroy any found, as these are the progenitors of the future summer and autumn swarms.

Destroy all egg masses which are generally found on the backs of the leaves of the plants attacked. The hope of artificial control lies in the destruction of the pre-adult stages. Once the bug has become adult and winged, it is most difficult to kill with sprays or dusts.

Bantam fowls allowed to roam in an infested crop, will help very materially to keep the pest in check.

BIOLOGICAL CONTROL.

As the Green Bug has assumed the role of a major pest and has proved so difficult of artificial control, efforts have been made to introduce and establish effective insect parasites. Through the good offices of Professor J. R. Watson, Head of the Department of Entomology, University of Florida, several shipments of a Tachinid Fly, *Trichopoda pennipes,* which is parasitic on the adult bug, have been forwarded during the past two years. Unfortunately all sendings to date have failed, no parasites having arrived alive at this end. We are deeply grateful to Professor Watson and those who have assisted him in making these efforts, and are still hopeful that some successful means of transportation will yet be evolved.

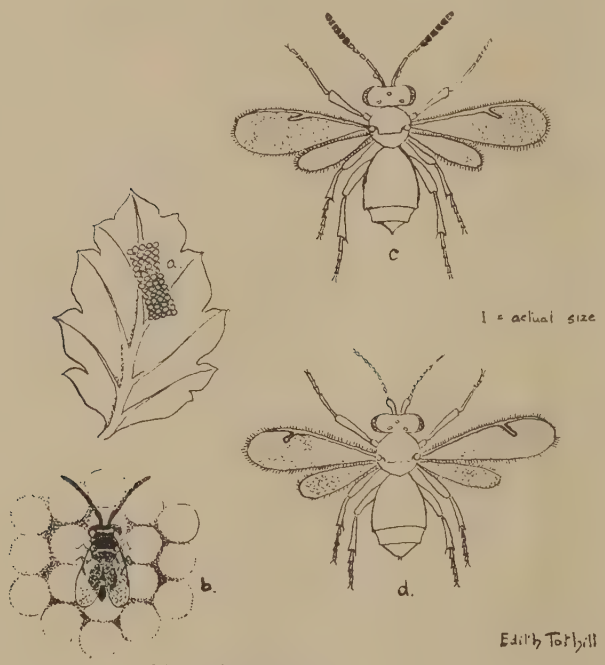
To Dr. H. Preisner, Chief Entomologist, Ministry of Agriculture, Cairo, Egypt, we are greatly indebted for the successful forwarding of an egg parasite of the Green Bug, *Microphanurus megacephalus, Ashmead.* This tiny parasite belongs to a group of wasps known as the Proctotrypidae. These are egg parasites, their larvae living inside the eggs of other insects, particularly bugs, butterflies, moths and flies. Various species are found in many parts of the world and several native species have been recorded from Australia. We have been successful in rearing from the Egyptian stock large numbers of this wasp locally for distribution. The methods of breeding and distributing employed, are for growers interested to collect and forward the bug egg masses to the Entomological laboratory. The eggs, as before stated, are laid on the backs of the leaves, which, to be of use for the breeding of the parasite, should be creamy yellow in colour. If they have turned pink, they are too advanced and should be destroyed. The eggs are submitted to the wasps for four to five days. When definitely showing signs of turning dark, which indicates that they have been successfully parasitised, they are removed from the breeding cages. These eggs are gummed to small strips of calico and mailed to the growers with instructions to stick or pin them to the backs of leaves of infested plants. *It is essential* to see that these parasitised rafts of eggs are not exposed to the direct rays of the hot sun.

The wasps hatch out in due course and seek out fresh rafts or masses of bug eggs to lay into, and thus the work of balancing nature is carried on. It is yet too early to make any definite statement as to whether this parasite will successfully negotiate our winter.

The body length of this wasp is 1/12th inch. The male has a black, non-metallic body, legs and antennae brown, wings clear with very reduced venation and covered with short cilia or fine hairs. Fore and hind wings with longer cilia around edges. The antennae are elbowed and moniliform. The female resembles the male in general, but has clavate or clubbed antennae, the enlarged segments being almost black. The life cycle from egg to adult takes from nine to ten days.

For the very excellent drawings of this parasite, I am indebted to Miss Edith Tothill, of Perth. In the breeding and distribution of the wasp I have been assisted by Mr. C. Jenkins, of this branch.

PLATE VIII.



Microphanurus megacephalus, Ashmead

(a) Egg raft (natural size)
(b) Parasite attacking eggs (enlarged)
(c) Female (multiplied by 13)
(d) Male " " "

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1. Froggatt, W. W., 1916—The Tomato and Bean Bug—Agr. Gazette, N.S.W., 27, pp. 649, 650.

2. E. H. Zeck, Assistant Ento., Agr. Gaz., N.S.W., Aug., 1933, Sept., 1933.

THE FEEDING OF CONCENTRATES TO HIGH PRODUCING COWS UNDER TEST IS PROFITABLE.

G. K. Baron-Hay, Superintendent of Dairying, and
L. C. Snook, Agricultural Adviser.

One frequently hears the statement made that the high yields of pure bred cows under official Herd Recording conditions are obtained at an uneconomical cost, and that the dairy farmer could not afford to feed concentrates as is the custom to cows under test.

From this statement, generally accepted as an axiom, it is but a short step to maintain that "the records of cows obtained under Herd Recording conditions are not a guide to the commercial dairy farmer wishing to purchase bulls with production ancestry, but may be a snare and a delusion."

It is interesting, therefore, to study the costs of feeding three cows which recently have completed a high yield under Pure Breed Recording conditions, especially as the three main dairy breeds are represented, the cows being:—

	Breed.	Date of Birth.	Owner.
"Banyule Silvermine 55th ,, (25473) ...	Jersey ...	... Aug. 2nd, 1928 ...	Sabina Vale Stud Farm
"Koojan Bonnie Elizabeth" (1899) ...	Guernsey	... Mar. 23rd, 1927 ...	A. W. Padbury
"Telyarup Duchess 1st" (2504) ...	A.I. Shorthorn...	Dec. 9th, 1928 ...	A. E. Grant

Two of the above cows are owned by breeders whose properties are situated in dry districts, namely, Mr. A. W. Padbury, at Koojan, average rainfall 18.51 inches, and Mr. A. E. Grant, near Geraldton, average rainfall 19.19 inches. The cost of feeding in low rainfall areas is higher than in the South-West of the State, but, even with this handicap, profitable returns are obtained.

On each monthly visit of the Official Recorder, a note is made of the concentrates and roughages being fed; the pasture also is inspected.

The cost of the total ration has been computed, using the prices listed in Schedule A. These prices are considered to be a fair average.

Details of the monthly rations and monthly productions of these three cows are shown in Schedule A-D. at the end of this article.

Table 1.—VALUE OF BUTTER FAT AT 9d. PER POUND COMPARED WITH COST OF FEEDING.

Name of Cow.	Breed.	Butter Fat Production.	Value of Butter Fat at 9d. per lb.	Value of Skim Milk at ½d. per gallon.	Value of Butter Fat plus Skim Milk.	Total Cost of Feeding.	Profit over Cost of Feeding.
		lbs.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Banyule Silvermine 55, Wonnerup	Jersey	660·5	24 15 0	2 5 4	27 0 4	11 13 1	15 7 3
Koojan Bonnie Elizabeth, Koojan	Guernsey	571·0	21 3 0	1 14 6	22 17 6	14 13 0	8 4 6
Telyarup Duchess 1st, Geraldton	A.I.S. ...	522·8	19 12 1	2 11 6	22 3 7	14 0 0	8 3 7

Table 1 above shows the saving that is made in cost of feed through good pasture being available for seven months of the year at Wonnerup, as against approximately only four months at Koojan and Geraldton. It is also significant to notice that all these cows received ample supplies of silage.

The average cost of feed per cow in the Herd Recording Scheme during 1932-33 was £9 per cow, the production being 308 lbs. of butter fat. The three cows here considered produced an average of 585 lbs. of butter fat, or 277 lbs. of butter fat more than the average Pure Bred Cow. In other words, for an extra feed cost of £4 8s. 8d. the value of butter fat produced was increased by £10 7s. 9d. It is apparent that with high producing cows, money spent on fodder is not wasted.

Banyule Silvermine 55th (25473).
Owned by Sabina Vale Stud Farm, Wonnerup.
Highest producing cow in the Senior Four-year-old Class, standard 330 lbs. butter fat. Produced 10,887 lbs. milk, 660·5 lbs. butter fat.

The production of these three cows from the whole milk point of view is also illuminating, and is shown in Table 2.

TABLE 2.—SHOWING VALUE OF WHOLE MILK AT 1/- PER GALLON COMPARED WITH COST OF FEEDING.

Cows.	Breed.	Production of Milk.	Value of Milk at 1/- per Gallon.	Total Cost of Feed.	Profit over Cost of Feeding.
		lbs.	£ s. d.	£ s. d.	£ s. d.
Banyule Silvermine 55th	Jersey ...	10,887	54 8 0	11 13 1	42 14 11
Koojan Bonnie Elizabeth	Guernsey ...	9,253	46 5 0	14 13 0	31 12 0
Telyarup Duchess 1st	A.I. Shorthorn	13,772	68 17 0	14 0 0	54 17 0

A perusal of Table 2 above shows clearly the high profit over cost of feed with such cows, where milk is being vended at 1s. per gallon, the average profit per cow being £42 14s. 11d. as against an average profit of £10 11s. 6d. per cow by the sale of butter fat.

It is obvious, therefore, at present prices that the producer of butter fat must of necessity feed his cows on more economical lines than producers of

whole milk at 1s. per gallon. This fact is shown clearly in the following Table 3:—

TABLE 3.—RELATIVE FEED COST OF PRODUCTION OF MILK AND BUTTER FAT.

Cows.	Milk.		Butter Fat.	
	Feed Cost per Gallon.	Average Market Price per Gallon.	Feed Cost per lb.	Market Price per lb.
Banyule Silvermine 55th	2·57d.	10d.	4·24d.	8d.
Koojan Bonnie Elizabeth	3·80d.	10d.	6·10d.	8d.
Telyarup Duchess 1st	2·44d.	10d.	6·42d.	8d.
Average	2·85d.	10d.	5·51d.	8d.

It will be noticed that no credit has been given for the value of the calf. Calves from such productive cows are exceedingly valuable, and constitute an important source of revenue to the breeder. It is here shown that these cows were not "forced" to produce uneconomically merely to boost the sales of progeny. On a butter fat basis, these cows have paid for their food and provided an average margin of £13 8s. from which to deduct labour and interest charges.

SCHEDULE "A."

PRICES USED IN ESTIMATING COST OF RATIONS FED.

	£	s.	d.	
Bran	5	10	0	per ton
Pollard	6	0	0	„
Crushed Oats	0	1	9	per bushel (40 lb)
Linseed Meal	0	14	6	per 100 lb.
Chaff	4	0	0	per ton
Silage	1	0	0	„
Grazing	0	1	6	per week
Grazing on cultivated crop	0	2	6	per week

SCHEDULE "B"

BANYULE SILVERMINE 55TH (25473)

Monthly Production and Food Consumption.

Month.	Milk.	Butter-fat.	Bran.	Linseed.	Crushed Oats.	Chaff.	Silage.	Pasture.
	lbs.	lbs.	lbs.	lbs.	lbs.			
June	1,455	93·90	...	...	180	...	...	Clover and green oats.
July	1,320	88·65	...	...	180	300	...	Good mixed—some grazing oats.
August ...	1,200	83·40	...	...	180	...	...	Mixed.
September ...	1,125	59·28	90	30	180	...	...	Mixed.
October ...	1,170	62·55	90	30	180	...	...	Mostly drooping flower clover.
November ...	1,245	69·27	90	30	180	...	...	do. do.
December ...	1,170	67·98	90	30	180	300	...	Mostly clover drying off.
January ...	1,080	66·72	90	60	180	300	...	Dry drooping flower clover.
February ...	1,122	68·80	99	66	198	330	...	Dry natural—some whole maize.
Total ...	10,887	660·55	549	246	1,638	1,230	...	

SCHEDULE "C."

KOOJAN BONNIE ELIZABETH.

Monthly Production and Food Consumption.

Month.	lbs. Milk.	lbs. Butter fat.	lbs. Bran.	lbs. Linseed.	lbs. Chaff.	lbs. Silage.	lbs. Pollard.	Crushed Oats.	Pasture.
June	1,170	66·06	90	45	60	600	...	...	Natural grass.
July	1,110	62·22	120	60	300	...	...	...	do.
August ...	1,140	66·03	150	45	360	...	...	...	do.
September ...	1,140	69·96	120	45	360	...	60	...	Green oats.
October ...	1,110	70·59	90	30	240	...	30	...	do.
November ...	1,080	69·60	150	45	240	...	...	...	Oats.
December ...	900	58·14	150	60	360	...	...	...	Dry oats.
January ...	795	53·13	150	60	360	...	...	...	Dry natural grass
February ...	808	55·24	132	33	...	990	...	60	Dry stubble
Total ...	9,253	570·97	1,152	423	...	1,590	90	60	

SCHEDULE "D."

TELYARUP DUCHESS 1ST.

Monthly Production and Food Consumption.

Month.	lbs. Milk.	lbs. Butter-fat.	lbs. Concentrate Mixture.	lbs. Chaff.	lbs. Silage.	lbs. Meadow Hay.	Pasture.
April	1,440	53·31	300	240	450		
May	1,380	52·47	330	240	...	300	Short mixed natural.
June	1,320	52·66	360	240	...	300	do. do.
July	1,470	66·00	360	180	...	...	do. do.
August	1,800	65·49	240	180	...	...	Fair but short natural pasture.
September ...	1,725	60·90	240	180	...	...	Fair mixed natural pasture.
October ...	1,740	61·56	150	180	...	...	Fairly good mixed natural pasture.
November ...	1,515	59·88	180	240	...	...	Fairly good mixed—dried off.
December ...	1,402	51·55	264	198	...	...	Fair mixed.
Total ...	13,772	522·82	2,364	1,938	450	600	

SOME STUDIES IN CHURN SANITATION.

Paper read before the Second Annual Conference of the Dairy Factory Managers and Secretaries' Association, February 16, 1934.

BY M. CULLITY, B.Sc. (Agric.).

This subject has been chosen as one that for two reasons is of particular importance to all factory operatives.

1. Churn cleansing is portion of the daily routine.

2. While it has long been accepted that the equipment with which dairy products come in contact, is an important source of bacterial contamination in these substances resulting in loss of keeping quality, churns have been definitely demonstrated by a large number of workers to be the principal source of recon-

tamination of butters. Recontamination undoes all the good work which may have gone before. The care exercised by the farmer in the production of his cream and its storage and the work of cream grading is nullified if by other factors in the treatment of the butter, it is found that good keeping quality is not achieved.

It is not proposed to criticise methods in use in this State or to state a method of cleansing that will be fool-proof, but it is intended to treat of work carried out by investigators in other parts of the world and their results. This work, though not carried out in our own factories, is none the less valuable and the essential principles are not altered.

The churn, because of its construction, is a particularly difficult piece of equipment to keep clean and has been shown repeatedly to be a prime factor in reseeding the cream with large numbers of micro-organisms. This reseeding or recontamination is particularly important, as it occurs after pasteurisation and, therefore, the organisms introduced have unchecked liberty to carry out their particular function.

It is not suggested that all the organisms which reach the butter from contact with equipment in the factory are sure to cause rapid deterioration. It is generally found that the bulk of the recontaminating organisms are of the bacillus type which may produce only slow changes, but others, even of the same type, can produce serious deterioration rapidly. Other types, however, are capable of producing rapid and extensive changes. The position is actually that nearly all the organisms are capable of creating harmful change. Under favourable conditions of storage, however, the change may not be noticed, but when allowed to come under conditions of temperature and storage, such as are found in retailing establishments, the condition of the butter may alter rapidly.

The fact that churns are usually constructed of wood, which is more difficult than metal to keep in a sanitary condition, renders the problem difficult. The surface is not so smooth and all sorts of depressions and minor cracks can shield organisms. The wood also tends to absorb moisture containing quantities of milk solids, placing a ready food supply available to the bacteria.

The combined churn and worker is naturally a still more difficult problem than the older types because of the inaccessibility of certain parts and the fact that working parts are present (bearings, etc.) from which it is impossible to prevent milk solids and fat accumulating. The greater the amount of wear in these parts, the greater the amount of material gathered. The severe strains set up during churning and, particularly during working in this type of churn, also tend to loosen joints, etc., allowing the formation of extra contaminating foci and also result in an ebb and flow of the material gathered in the out of the way places.

Various investigations have been carried out and will be discussed under headings according to the method of treatment.

1. Hot water and alkalies, etc.
2. Germicides.
3. Boiling water and steam.
4. Lime.
5. Various.

Lund reported that neither treatment with hot chloride of lime nor with scalding hot water was successful in removing contamination, but found that when hot alkali solution followed by hot freshly prepared milk of lime was used,

the yeast count was greatly reduced. He also pointed out that where heavy recontamination by moulds takes place, that still heavier recontamination by bacteria occurs also. James stated that hot water plus washing powder was not effective. In further trials, using germicides in addition to heat treatment, more successful results were obtained. He stated "increase in temperature and in period of exposure greatly favoured the chemical treatment and temperature of medium, fulness of churn and length of exposure were apparently the cardinal factors in churn cleaning." This worker drew attention to the difficulty of sterilising churns because the sterilising medium does not come into contact with all the organisms which may be in inaccessible places. He showed that the organisms obtained from churns could be killed at temperatures and in solutions of germicides as used in practice. This was done by treating suspensions of organisms obtained from churns with ordinary dilutions of germicides, etc. The fact that organisms can lodge in inaccessible places in churns has probably been forcibly demonstrated to all of us from time to time, e.g., between the staves of the barrel or in the rolls of the workers, or in the glands, and it is the difficulty of getting at these accumulations which renders the work of cleansing the churn particularly difficult.

The effect of using a germicide in addition to hot water has been the subject of investigation by a number of workers. Lund and James have been already mentioned. Gregory found a commercial germicide effective, as did also Shutt. Morrison, Macy and Combs, however, found sodium hypo-chlorite and choramine T ineffective. Hammer and Olsen found that the use of chlorine on churns treated with hot water resulted in reductions of the numbers of organisms. In general, it would appear that results from the use of these preparations depend largely on the previous treatment of the churn—the concentration of the chlorine compound, the temperature, and the time of exposure. The data seems very indefinite and no sure conclusion can be drawn from it.

The use of boiling water prior to the treatment with chlorine seems, to my mind, to be a dominating factor, particularly in view of the work of Haglund, Barthel and Waller, who studied four churn-cleaning methods—(1) hot water, (2) hot water and a coating of lime, (3) hot milk of lime, (4) water heated to boiling with steam. The last method was found most effective, as butter free from yeast and mould could be made from it. Butters manufactured after this treatment also showed superior keeping quality. This would indicate that the numbers of bacteria present were also reduced.

In Danish experiments it was found that only water heated to boiling with steam was effective in destroying harmful bacteria, while according to Morrison, Macy and Combs, "Sufficient exposures to hot water and flowing steam were the most satisfactory methods for the treatment of churns." Results from the work of these men are also of interest as they illustrate the extreme difficulty of sterilising beneath the actual surface of the wood. They found that when a churn was exposed to boiling water, it required a period of 1½ hours for heat to penetrate the wood to a depth of $1\frac{3}{8}$ inches and raise the temperature to 144 deg. F." Hence the great necessity of prolonging the heat treatment in cleansing, not only the length of time of washing, but the actual temperature of the washing medium must be kept up, even if it is necessary to stop the churn and to introduce the steam hose. Hammer and Olsen found that churns regularly treated with hot water commonly contained relatively few organisms. They also found that the bacteria found in churns were largely types resistant to ordinary degrees of heat.

The use of lime is fairly widespread, so the results of work carried out on this substance will be of interest.

Gregory found that with overnight treatment with a suspension of lime, after hot water treatment gave unsatisfactory results, the only advantage of the lime was that it improved the odour of the churn. Ruehle advocated frequent sterilisation and advocated soaking for three days in milk of lime followed by several rinsings of hot water for new churns or old ones which had stood idle for some time. Hood and White (Canada) suggested that contamination is not serious if liming be practised regularly. Shutt found that treatment with boiling lime solution for five minutes, then diluting this to the capacity of the churn and holding for three days was not so successful in reducing contamination, as when the churn was treated with boiling lime for 30 minutes before diluting. This system of liming the churn was first recommended by Lund and is strongly advocated by Hood and White for the treatment of badly contaminated churns.

Mention may be made of two other substances that were investigated. Shutt carried out trials with sulphuric acid but found the results not satisfactory. "Salting the churn" was found by Caulter to be effective in reducing the yeast and mould content of butter, but Hammer and Olsen found that the total number of organisms as indicated by the Agar Disc method was not appreciably reduced. Morrison, Macy and Combs found also in their heat and germicidal treatments, that it was considerably easier to eliminate moulds than it was bacteria.

This would indicate that yeast and mould counts of butter are principally useful when positive results are obtained, for it has been demonstrated frequently that high yeast and mould counts go hand in hand with higher bacterial contamination. If it is easier to destroy the moulds, etc., than the bacteria, it is reasonable to conclude that when the low mould counts are obtained it does not indicate definitely that bacterial contamination is also low.

Occasionally arguments are used against certain methods of cleansing because of their effect on the surface of the wood. Both heat and the chlorine treatments have a softening effect. However, this is a false argument to accept if it means the institution of an ineffective cleansing system, as the action of the bacteria and their products will soon show a very injurious effect on the wood. The inclusion of a regular lime treatment would do much to counteract the softening influence of heat by hardening the surface of the churn and by filling the pores.

Advocacy of one particular system of cleansing is not intended, but emphasis must be made on the outstanding factors in the work referred to. The actual method or routine of doing the work does not matter so long as the principles underlying sterilisation are complied with. These are, in essence, heat and a reasonable period of exposure. Occasionally the thoroughness with which churn washing is carried out leaves much to be desired. The method used by Hammer and Olsen in their studies on the micro-organisms in churns is simple and may be quoted as an example, which, if applied regularly, would keep churns in a satisfactory condition.

The general procedure used on the churns was as follows:—

1. The milk solids were rinsed from the churn by adding water at a temperature of from 100deg. to 120deg. F., revolving the churn for several minutes and then draining it.

2. The churn was filled one-third to one-half full of water at 170deg. to 180deg. F., soda ash added at the rate of about 1 pound per 100 gallons of water, the churn revolved in high gear for about 15 minutes and drained.

3. The churn was filled about one-half full of water at not less than 180 deg. F. and preferably at 200deg. F. or higher, and revolved in high gear for about 15 to 20 minutes. It was then drained thoroughly and turned so that the door opening was about two-thirds of the way up; in this position the churn dried rapidly. After the churn was dry a frame covered with screen was placed in the door opening. In some of the latter trials muslin was used over the screen as a protection against contamination from the air. About once a week slaked lime (free from sand, gravel, etc.) was added to the last water at the rate of about 1 pound per 100 gallons of water.

4. Before use the churn was rinsed by filling it one-third to one-half full of water at about 50deg. F., revolving in high gear for 5 minutes and then draining.

They concluded, as mentioned previously, that churns regularly treated in this manner contained relatively few organisms.

It will be noticed that the two aspects referred to above are taken care of. Water, heated as near to boiling temperature as it is possible to get it is the final washing, and this is applied after a really hot treatment with soda ash. Actually the period of exposure to high temperatures was about half an hour. This would allow the heat to penetrate to some distance under the surface of the wood. It is suggested that, when heating water in a churn by way of a steam hose, a thermometer should be used, as it often happens that water is thought to be near boiling temperature when actually it is still a long way from it.

Reference can be made in conclusion to the Agar discs method of studying the degree of contamination from factory equipment. Photographs and actual discs have been demonstrated on the department exhibit obtained from our own factories. The system of studying the contamination in this way is such that it can be applied in the factory and the results watched without recourse to detailed laboratory work. The discs obtained appeal to the factory man, as an actual print or cast of the surface being studied is taken. The melted agar is poured direct on the surface and, when sufficiently solid, can be transferred to a sterilised petri dish.

A drawback to the method, however, is that it cannot give any indication of the condition of inaccessible places in the churn. The only way of studying the condition of the churn as a whole is by the rinse method from which the results can be worked out only in the laboratory and stated in figures—so many per cubic centimetre. The number would vary according to the amount of the water used and its initial bacterial content. The agar disc count is expressed as so many per square centimetre of surface, and this allows direct comparisons between churn and churn to be made in a way that can be appreciated by all.

The added advantage of demonstrating to the eye the actual degree of contamination is particularly valuable, and one which appeals to the factory worker.

IMPROVEMENT OF PASPALUM AND SUB-CLOVER PASTURES.

T. C. Dunne, Merchants' Research Officer, Muresk Agricultural College,
and
H. K. Gibsone, Assistant to Officer in Charge of Irrigation.

The old irrigated pastures of the Harvey area have been in the main, dominantly paspalum in the summer and sub-clover in the winter and spring. In general these pastures have two defects, viz.:—

1. The rather low protein content of the paspalum.
2. The low production during the winter months.

1. *Low protein content of paspalum.*

For economical milk production, dairy stock need a reasonably high percentage of protein in the pasture. The protein content of most pasture species decreases as the plants develop. Under conditions of adequate moisture and warmth, paspalum makes abundant growth. Very often it is found that the number of stock which can be carried on the pasture throughout the year are unable to cope with the summer flush of feed. The paspalum grows long and there is a rapid decrease in the protein content.

The protein content of grasses may be greatly increased by the application of nitrogenous fertilisers. Except in special cases, however, high expenditure is not profitable with the existing price levels for dairy products.

Good management of the sward is profitable. This includes—

(a) Rotational grazing of paddocks, whereby the milking cows may be always on young fresh growth;
(b) use of the mowing machine whenever the stock are unable to cope with the rate of growth of the pasture;
(c) regular spreading of droppings whereby a cheap form of nitrogen is distributed and rank ungrazed patches are avoided.

In addition to good management, the inclusion in the sward of a species having a normally high protein content will greatly improve the nutritive value of the pasture and will, in fact, tend to provide a "balanced" feed. It has recently been demonstrated moreover, that a non-legume such as a grass, growing in association with a vigorous legume, may actually absorb nitrogen compounds secreted by the root nodules of the legume and thus increase its protein content. The obvious species for improvement is a clover making good summer growth. This method of improvement should be permanent.

2. *Low production during early winter.*

There is a period in early winter when paspalum is dormant and sub-clover makes little growth. Usually heavy hand feeding of stock is necessary. This situation may be eased to some extent by the provision of pastures consisting of winter growing species or by the introduction of a winter growing species into the existing pasture.

An attempt was therefore made to introduce white clover and perennial rye grass into an old paspalum pasture. The purpose of the white clover was to improve the protein content of the pasture and of the rye grass to provide some early winter feed.

The best seed is always the most profitable for permanent pasture. In this trial seed of New Zealand certified mother strain perennial rye grass and of New Zealand certified white clover was used.

The site selected for the experiment was an old paspalum and sub-clover pasture which had been ploughed in June, 1931, for purposes of renovation. By

the autumn of 1932, the paspalum had made fair recovery but the growth of couch grass had been stimulated considerably. However, the growth had not, at that time, been sufficient to completely cover the soil.

The surface soil was loosened with a spike harrow. One half of the paddock was left as control and, on May 15, 1932, the other half was seeded at the following rates, viz.:—

White clover .. .. 4 lb. per acre.
Perenial rye grass .. .. 20 lb. per acre.

A good germination of rye grass and a fair germination of white clover were effected. By August, the grass had made good growth but the clover plants were still small. The pasture was cut for hay in November, by which time a number of seed heads of rye grass had been formed and the white clover was beginning to spread. Thereafter the pasture was almost continuously grazed and provided good winter feed from both the rye grass and the clover. The white clover spread rapidly and by June, 1933, had covered most of the sown area.

A fertiliser mixture of 4:1 super and sulphate of ammonia was applied at the rate of 2 cwt. per acre in the autumn and 1½ cwt. per acre in the spring. During the summer months the plot received four monthly waterings commencing in December, 1932. In addition, the pasture received winter and summer harrowing.

The paddock has since been subjected to almost continuous grazing. The white clover has continued to spread and make good growth. The growth of the rye grass has been satisfactory, but a true estimate of its value should be obtained by further observation during the coming winter.

By no means the least satisfactory aspect of the experiment is the increased palatability of the pasture as a whole. On the control area, there are present large patches of paspalum and dry couch grass which are always left by the stock. On the other hand, the portion containing white clover has been grazed very closely and evenly and the presence of couch grass can be detected only by close observation. Both the couch grass and the paspalum have a particularly healthy dark green appearance, presumably owing to their association with the clover.

Hitherto, in this pasture, the prevalence and spread of a water weed (*Heleocharis capitata*), growing mostly in poorly drained patches and in the furrows, has caused some uneasiness. During the summer this plant grew to a height of about six inches and seeded. It had a yellow appearance and was ungrazed by stock. With the establishment of white clover, the plant has apparently derived benefit from the supply of nitrogen secreted by the root nodules and has developed a healthy green appearance. Presumably owing to an increase in palatability, it is now kept very short by the stock. Grazing of this nature, if not totally eradicating the weed, will at least prevent its further spread.

The results of the experiment to date indicate that the carrying capacity, nutritive value and palatability of a paspalum and sub-clover pasture may be considerably improved by the introduction of a good strain of white clover. It is considered, from the results of this and other experiments, that all seed mixtures being sown under irrigation conditions for permanent pasture should contain at least 2 lb. per acre of New Zealand certified white clover. At present the success and value of perennial rye grass under these conditions are less definite. A better estimate can be made in the light of further data.

For the purposes of establishment, ploughing may not be necessary. Any type of cultivation which gives sufficient bare ground for the germinating seedlings to obtain a good root hold would be satisfactory. The sowing should be done in the autumn to avoid undue early competition from the paspalum.

The rate of seeding in the experiment was high. White clover at the rate of 2 lb. per acre and perennial rye grass at the rate of 10 lb. per acre should give satisfactory results.

In the experiment, seed of *Phalaris tuberosa* at the rate of 3 lb. per acre was also sown but was a complete failure. This is understandable from the results of other experiments which have shown that this grass can be successfuly established only when the competition from other species, in the first year of its growth, is reduced to a minimum.

VIRUS DISEASES OF PLANTS.

WITH PARTICULAR REFERENCE TO THE SPOTTED OR BRONZY WILT DISEASE OF TOMATOES.

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The following is a general account of that group of plant diseases brought about by the presence in the sap of parasites so small as to be quite invisible, even with the highest powers of the microscope. How the presence of these invisible, filter-passing organisms is proved is discussed, and some of their most interesting properties indicated. Artificial and natural methods of infection and the role of insect carriers, such as aphids and thrips, in the spread of virus diseases are referred to. It is indicated that the virus responsible for the spotted wilt disease of tomatoes has recently become a serious menace to the successful growth of many flower-garden plants.

DEFINITION OF DISEASE.

Before one can appreciate the special importance and significance of those diseases of plants belonging to the Virus group, it is necessary to have a clear-cut idea of just what is meant by the term "disease" itself.

Disease may be defined as any condition of a plant, quite irrespective of its cause, which tends to reduce its vigour or to shorten its life, or to detract in any way from the quantity or quality of the yield which might reasonably be expected under ideal conditions. In a shorter and more simple manner we may say that disease is any condition of a plant which falls short of perfect health. Perfect health results only from the inter-action of perfect heredity and ideal environment, two requirements which are, of course, rarely found separately, and even less commonly in combination.

CAUSES OF PLANT DISEASE.

Plant diseases may be brought about by living or non-living causes. Those diseases which are caused by attack on the plant by some other living organism or parasite are known as *parasitic* diseases. Those which are caused in any other way are called *non-parasitic, physiological,* or *physiogenic.*

NON-PARASITIC DISEASES.

Some examples of non-parasitic diseases, which can only be mentioned in passing, are the "Grey Speck" disease of wheat and oats, which occurs in this State on those soils where there is, in certain seasons, a deficiency of available manganese in the soil; the die-back, gumming, or "Exanthema" disease of orange trees, which

Fig. 1.—Tobacco leaf affected with Tobacco Mosaic. Note the dark green blistered areas (healthy) in strong contrast to the larger yellowish or light green areas (diseased) forming the greater part of the area of the leaf.

After L. F. Mandelson, from "Tobacco Diseases," in "Tobacco growing in Queensland," Dept. Agriculture and Stock, Queensland, 1933.

appears to be brought about by a deficiency of copper and which can be prevented or cured by the application of powdered bluestone to the soil or by routine spraying with Bordeaux Mixture; "Water Core" disease of apples which is brought about by the exposure of the fruit to unduly high temperatures during heat waves; "Blotchy Cork" disease of apples which is brought about by the leaves drawing water back from the fruits during periods characterised by very hot drying winds; true "Bitter Pit" of apples which is caused by the mere fact of picking the fruit of susceptible varieties after it has begun to ripen but before it is sufficiently mature; "Streak" or "Stripe" disease of sweet peas or tomatoes which is induced by over-liberal manuring with nitrogenous manures and insufficient use of sulphate of potash; "Yellow Berry" disease of wheat, which is due to a deficiency of available nitrogen in the soil; and "Sour Sap" of apricots and other stone fruits, which often results from inadequate drainage.

One of the best known examples of a non-parasitic disease in this State is the burning back of the edges of the leaves of loquat or plane trees, grape vines, etc., during periods when the root system is unable to absorb water from the soil as fast as it is being transpired ("evaporated") from the leaves by the hot drying winds of our very severe summer. A further very clear cut example of a non-parasitic disease is frost injury on wheat, which was very much in evidence on wheat heads, leaves and stems in this State during 1932. (See "Journal of Agriculture" for June, 1933, pp. 286-291, or Leaflet 379.)

PARASITIC DISEASES.

Turning to the parasitic diseases we find that these are caused by living organisms such as bacteria, fungi, slime moulds, eelworms, insects, or even certain flowering plants, such as broom-rape which occurs very commonly in the metropolitan area, living on the roots of cape weed, clover, and so on: dodder, which attacks lucerne and clover, etc.: mistletoe, which attacks the native eucalypts: or the much admired Christmas tree (*Nuytsia floribunda*), which is quite unable to support itself by its own unaided energies on the nourishment obtainable by other plants from air and soil, but lives as a parasite on the roots of practically any kinds of plants growing within its reach.

VISIBLE AS DISTINCT FROM INVISIBLE PARASITES.

Now even though many of these parasites such as bacteria, fungi, slime moulds, etc., are quite invisible to the naked eye, they are very easy to see, and in fact appear quite enormous, under the magnification of a high powered modern microscope. All the groups of parasites so far mentioned are, therefore, lumped together by scientists under the general heading of visible parasites, inasmuch as by one means or another they can be readily seen.

VIRUS DISEASES OR DISEASES CAUSED BY INVISIBLE PARASITES.

Since 1892, however, when Ivanowski concentrated his attention on a previously neglected disease known as tobacco mosaic, we have come to recognise a very large group of plant diseases as being caused by parasites (or causal agents of some kind) of such minute size as to be quite invisible even with the highest powers of the microscope. At the present time there is very much more work being done throughout the world on plant diseases of this type than any other, and, during the past 30 years, an enormous literature on the subject has been built up; yet no one has ever seen the cause of any one of these particular diseases or has the faintest substantiated idea of what it looks like. Diseases which are brought about by parasites or causal agents of this type are known as Virus diseases.

Some readers may be inclined to suggest that the magnification of our microscopes should be increased if these organisms cannot be seen with our present ones. Such a suggestion leads nowhere, however, inasmuch as the ability to see

Fig. 2.—Healthy "Delaware" Potato Plant. Notice great vigour of growth, abundance of soft foliage, and entire absence of mottling, wrinkling, or rolling of the leaflets. Compare with Figures 3, 5 and 6.

After W. M. Carne, this Journal, June, 1927.

objects with the microscope depends on the objects looked at being of sufficient size to interfere with the passage of light through the lenses and so throw an image on an illuminated background, but it has been shown that the viruses

are smaller than the wave length of light, so that they do not interfere with its passage and consequently remain, and may forever remain with the present type of microscope, invisible.

Fig. 3.—Potato plant with "crinkly mosaic." Photographed to same scale as Fig. 2. Notice mottling and crinkling of many of the leaflets, especially those near the top of the plant. Such plants give considerably lower yields than healthy plants grown under identical conditions, and they act as centres of infection to the healthy plants round about. The disease is spread by means of infected tubers, aphids, and perhaps also by other kinds of sucking insects. Symptoms of the disease show up very plainly in the winter months, but may be entirely obscured during the summer on account of the high temperatures. All such plants should be removed from the "stud plots" and destroyed.

After W. M. Carne, this Journal, June, 1927.

As further indicating the exceedingly small size of these viruses, it may be added that a characteristic feature is their ability to pass through porcelain Chamberlain and Berkfeld filters of such a fine degree of porosity as to completely filter out of the solution any known visible parasites.

How is it then, some will ask, if scientists cannot see these organisms and cannot filter them out of a liquid in which they occur, that they can be certain there is any parasite present in a plant suffering from one of these mysterious virus diseases? The explanation is simple. If one takes a perfectly healthy tobacco plant, grinds it up in a meat mincer, squeezes out the sap with a mortar and pestle, filters the sap through a porcelain filter candle to remove all visible matter, then injects this filtered sap into another healthy tobacco plant and sets the latter aside to await developments, one may wait forever without the second healthy tobacco plant being any the worse for its experience. But, if the experiment is now repeated with one modification only, viz., that a tobacco plant affected with tobacco mosaic disease is crushed up and its filtered sap injected into a healthy one, it will be found, after waiting for about fourteen (14) days, that the inoculated tobacco plant, with almost dramatic suddenness, has developed unmistakable symptoms of tobacco mosaic, and this process may be repeated from the second to a third plant, and so on an infinite number of times, with always the same result.

A further surprising fact is that if the sap of a mosaic tobacco plant is diluted with 10,000 times its own volume of sterile water, it still remains infectious. So infectious, indeed, is this particular virus disease that if a needle be lightly rubbed along the surface of a tobacco leaf affected with mosaic and then be similarly lightly rubbed along the leaf of a healthy plant the disease may be readily transmitted, and yet the lightness of rubbing may have been such as to cause no obvious wounding or injury of any kind to either plant. Another curious feature of most plant viruses is that they are remarkably resistant to poisonous substances such as ether, chloroform, toluene, carbon-bi-sulphide, carbon tetrachloride, etc., which are very rapidly fatal to many known visible parasites. The virus of tobacco mosaic will resist putrefaction of the sap for fifteen (15) months and will live in dried tobacco leaves indefinitely.

SIGNIFICANCE OF THE TERM "MOSAIC" DISEASE.

The tobacco mosaic disease is readily spread about a field on the fingers of the farm workers. Affected plants become more or less stunted and yellowish, have smaller leaves than normal, and, in any leaves developing after the inoculation took place, irregularly shaped elevated blisters of intensely green tissue occur scattered through the general yellow background of the bulk of the leaf. The alternation of these dark green (healthy) and yellowish (diseased) patches causes a pattern somewhat suggestive of a tiled mosaic floor, from which fancied resemblance the term "mosaic disease" has been derived.

The natural method of transmission of the tobacco mosaic virus is by means of sucking insects known as aphids.

VIRUS DISEASES OF ANIMALS, MAN, AND PLANTS.

Virus diseases are not confined to plants, but are found also in animals, including human beings. Well known virus diseases of the lower animals are:—Hog Cholera (Swine Fever); Rabies of Dogs; Dog Distemper; Foot and Mouth Disease of Cattle; Rinderpest of Cattle; and Jaundice of Silk Worms (8).

In man occur:—Infantile Paralysis; Smallpox; Mumps; Measles; Hydrophobia and Warts (8).

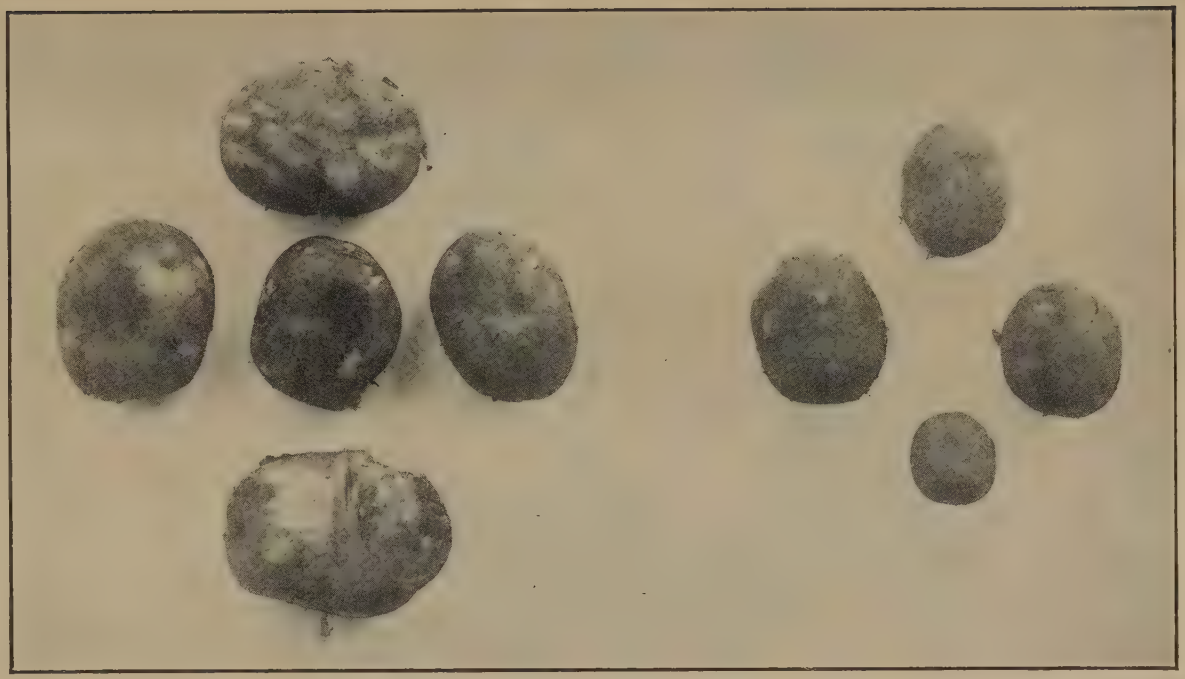

Fig. 4.—A. Potatoes from healthy plant in Fig. 2.

Fig. 4.—B. Potatoes from "crinkly mosaic" plant in Fig. 3.

After W. M. Carne, this Journal, June, 1927.

In plants the most outstanding are:—Peach Yellows; Little Peach; Peach Rosette; Curly Top of sugar beets; Aster Yellows; the various Mosaic diseases of tobacco, tomato and potato; and in Australia—Bunchy-top of bananas (3); Spotted or Bronzy Wilt of tomato (1, 5, 6); Bullet or Woodiness of passion fruit (4); tomato, tobacco, and potato mosaic; and potato "Leaf Roll."

Even the bacteria are not free from virus diseases but may be attacked and destroyed by invisible agents called *bacteriophage* (8).

Fig. 5.—Advanced "Leaf Roll" of Potato. Affected plants are usually smaller than healthy ones, and they often have an unusually large number of branches, each, or some of which, bear a number of brittle, thickened, yellowish, sometimes purple-tinted, rolled leaflets. The whole of an affected plant often has a stiff, pale, yellowish appearance, and the rolled leaflets give out a characteristic rattle when the plants are shaken. "Leaf-roll" causes a much more serious reduction in yield than either "mild" or "crinkly mosaic." The disease is carried by aphids or infected tubers. It is not "masked" by high temperatures.

(*Photo. N.S.W. Dept. Agric.*).

"DEGENERATION" OR "RUNNING-OUT" OF POTATO VARIETIES.

The so-called "degeneration" or "running out" of potato varieties which has been known in agriculture for a very considerable period has comparatively recently been shown to be due to the gradual accumulation of virus diseases within the variety as time goes on, unless deliberate efforts are made to prevent it. The old practice was to introduce a new variety of potatoes raised from the true seed, as distinct from tubers, as soon as the yields of the old variety became so low as to render it unprofitable. This method was successful inasmuch as it so

Fig. 6.—Severe form of "rugose mosaic" on Bliss Triumph potato plants. Any plants showing such symptoms should be immediately destroyed.

After the photograph by B. F. Dana, in Heald's "Manual of Plant Diseases."

happens that the dissemination of virus diseases by true seed is not usual. But it is now known that there is no reason why the same variety should not continue to yield heavy crops from now on for ever, provided that steps are taken to keep virus diseases in check by elimination of any diseased plants as soon as noticed and by the ruthless suppression of aphids and other insects by which they are naturally spread from plant to plant. The Certified Seed Scheme operating in this State aims to keep the seed potatoes as free as possible from virus diseases. (See "Journal of Agriculture" for June, 1930, pages 347-353, or Leaflet No. 305.)

TRANSMISSION OF VIRUS DISEASES BY SPECIFIC INSECTS.

While most virus diseases which are naturally transmitted by aphids are also readily transmissible from plant to plant by human inoculation, as explained earlier, those virus diseases which are naturally transmitted by means of other kinds of insects can often not be transmitted by human inoculation. Thus, "Curly Top of sugar beets" "Streak" disease of maize, and "Aster Yellows" are all transmitted by their own particular insect carriers or vectors—in these cases not aphids but leaf-hoppers, and in no other way, organic union by grafting or budding excepted.

While working at the Waite Institute in Adelaide in 1927, the writer discovered that the "Spotted Wilt" disease of tomatoes is transmitted by a species of thrips—*Thrips tabaci* (5)—this being the first case of a virus disease being definitely proved transmissible by thrips. Subsequent work by Messrs. Samuel and Bald indicated that the black carnation thrips—*Frankliniella insularis*, is also a carrier of this disease (1, 6). All attempts to artificially transmit this disease by means of inoculation with infected sap failed until these two workers developed a special technique, as a result of which it is now possible to produce the disease by artificial inoculation with a very high degree of certainty (1).

Fig. 7.—Two "Burwood Prize" tomato plants artificially infected with "Spotted Wilt" by placing on each of them five larval thrips taken from naturally infected tomato plants. The two large plants were uninfected "controls" on to which no thrips were placed. All the plants were the same size (being only several inches high) when the experiment commenced with the use of the thrips five weeks previously. The "control" and "experimental" plants were grown alternately as indicated above and received identical treatment in every way, except for the placing of infective thrips on to the "experimental" plants (occupying positions 1 and 3 reading from the left). The photograph was taken about three weeks after the first appearance of symptoms and when the affected plants had commenced to make a little new growth (which often happens when the plants are grown under experimental conditions and are carefully tended).

After H. A. Pittman, Journal of the C.S.I.R., November, 1927.

As indicative of the great economic losses which may be caused by a virus disease, it may be stated that following on the outbreak of the "Bunchy top Disease of bananas" in northern New South Wales, 90 per cent. of the banana plants were rendered useless between 1922 and 1927. In southern Queensland in the Curumbin district the disease proved so disastrous that the railway freights fell from £20,000 per annum in 1922 to a paltry £500 in 1925 and the weight of bananas sent from the station fell from 4,400 to 110 tons (3).

Fig. 8.—Bronze markings of "Spotted" or "Bronzy Wilt" on a leaf of a "Golden Queen" tomato plant from the field.

After G. Samuel, J. G. Bald, and H. A. Pittman, Bull. 44, *C.S.I.R.*

In Western Australia the most important virus disease at the present time is the "Spotted" or "Bronzy Wilt" disease of tomatoes. This disease annually wipes out hundreds of thousands of tomato plants in most of the Australian States, although it was quite unknown in Australia prior to 1915-1916, in which season it was first noticed in the vicinity of Melbourne (6).

SYMPTOMS OF SPOTTED OF BRONZY WILT OF TOMATOES.

Almost everyone who has tried to grow tomatoes in the neighbourhood of Perth will be only too familiar with the symptoms of this dread disease. Tomato plants which one night appear perfectly healthy may on the following morning show a very characteristic shining, spotted, or more generally diffuse bronziness or copper colour on the topmost surfaces of the topmost leaves. If the plant has been allowed to branch so as to form a number of separate stems, the youngest leaves at the top of each shoot may show these shining bronzy symptoms more or less simultaneously. The affected plants stop growing at the time of appear-

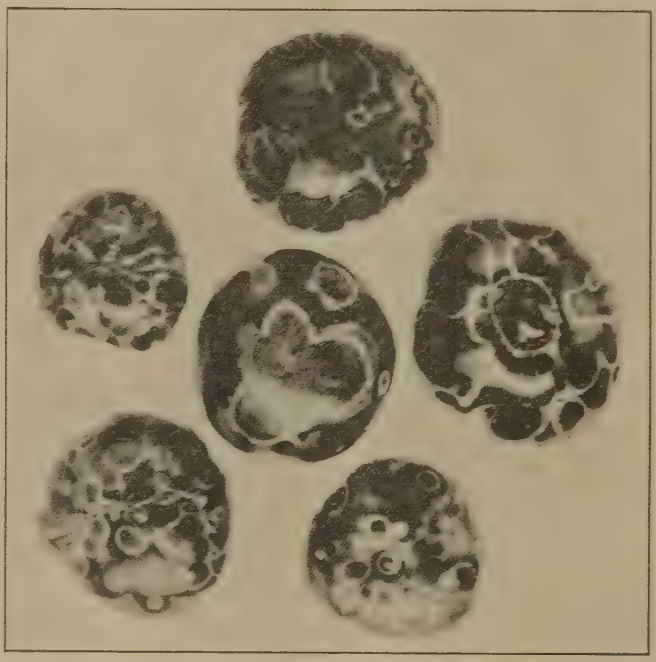

Fig. 9.—Yellowish markings on the ripe (red) fruit of "Early Dwarf Red" tomato plants which were affected with "Spotted Wilt." Such fruits have a very poor flavour and poor general quality.

After G. Samuel, J. G. Bald, and H. A. Pittman, Bull. 44, C.S.I.R.

ance of the bronzy markings and in the course of a week or so show up as badly stunted plants by contrast with any of their neighbours which may still be healthy. The rather pretty bronzy freshness of the original lesions only lasts for a very few days, after which the affected leaves during hot weather become very much shrivelled and dried up. Flowers present at the time of appearance of the symptoms will, of course, wither and die, but side shoots may develop from the stems; any fruits present may develop red and yellow mottlings, or more rarely, bronzy rings, as they gradually ripen up. No more fruits will be formed and the quality of the mottled ones will be very inferior. Plants attacked when young usually

die outright, but older ones may struggle along unthriftily for months after managing to survive the first drastic consequences of infection, never being of any further use to the grower from a commercial point of view.

MANY FLOWER-GARDEN PLANTS SUSCEPTIBLE TO SPOTTED WILT.

As indicated earlier, this disease is naturally transmitted from plant to plant by two species of thrips. Both these thrips occur commonly in many garden flowers and it has been shown recently by Bald and Samuel at the Waite Institute (1) that not only do the garden flowers harbour the thrips, but that many garden flower plants may actually become infected with the "Spotted Wilt" disease itself and serve to spread the disease to tomato plants in the vicinity. A number of the susceptible garden flower plants are winter growers, so that in this way the disease is carried through that portion of the year when the tomatoes are not being grown out-of-doors.

Fig. 10.—On left, two leaves of the garden Zinnia, *Zinnia elegans*, from a plant mechanically inoculated with tomato "Spotted Wilt" 29 days previously. Photographed 17 days after the appearance of symptoms. Leaves from "control" (healthy) plants on right.

After J. G. Bald and G. Samuel, Bull. 54, C.S.I.R.

Some of the garden flower plants found by experiments at the Waite Institute to be susceptible to the "Spotted Wilt" virus are:—schizanthus, aster, chrysanthemum, zinnia, iceland poppies, nasturtiums, petunia, and salpiglossis. Tobacco, cape gooseberries, egg plant, chilis, black night shade and apple of Sodom have also been infected (1).

In England, where the disease broke out in tomato glass houses some three years ago, the following additional plants have been found susceptible:—dahlia, cineraria, potato, lupins, and broad beans (2).

In Western Australia it has been impossible to carry out any investigations with virus diseases, as such investigations demand an insect-proof glasshouse, but symptomatic evidence indicates that the "Spotted Wilt" virus has for several years now played havoc with:—dahlias, especially seedlings, Iceland poppies, asters, *Calliopsis drummondii*, nasturtiums, ranunculi, anemones, and perennial scabious, while it has been less serious on petunias, yellow and ordinary cosmos, English marigolds, and columbines. During the spring of 1933 many beds of ranunculi and anemones in the metropolitan area were almost completely wiped out by the ravages of this disease. (The "evidence" for the statements made in this paragraph is "symptomatic" and "circumstantial," not experimental.)

The symptoms shown by garden flower plants affected with "Spotted Wilt" are not very similar to those of the tomato, and it is only the trained eye that can accurately diagnose the cause of the trouble as due to the Spotted Wilt virus in many cases. Common symptoms are a "clearing" of the green colour along or adjoining the veins, a faint bronzy or brassy hue on the uppermost surfaces of affected leaves, death and rotting of petiole (leaf-stalk) tissue, and the development of dead sunken patches on flower stalks. Iceland poppies, anemones, and ranunculi are rapidly killed or may linger and not produce any further normal flowers. The young leaves of dahlias are often reduced to little more than mid-ribs, while whitish hieroglyphical markings or more or less irregular whitish concentric circles may appear on older leaves. Flower buds of dahlias are blackened, while dahlia seedlings may be killed out in hundreds a few weeks after planting out into the flower beds. Dahlia plants grown from tubers do not suffer so seriously as seedlings, especially if they receive ideal treatment and are planted in soil containing a considerable amount of loam, rather than the almost pure sand characteristic of the metropolitan area. The basal leaves of dahlias affected with the Spotted Wilt virus show a very pronounced tendency to dry up in hot drying winds. Varieties with white or light-coloured flowers appear on the whole to be more seriously affected than those with red or other dark-coloured blooms.

THE CONTROL OF VIRUS DISEASES.

The problem of the control of virus diseases is one which obviously presents great difficulty, inasmuch as it is exceedingly difficult to exercise 100 per cent. control of insect carriers with any of the methods at present known to science, and it is obvious that only by complete eradication of these insect carriers, combined with the immediate destruction of all diseased plants, can we hope to successfully deal with the problem, unless resistant varieties are bred or some entirely new means are discovered for rendering the plants either tolerant or immune.

Tomato growers should avoid growing tomato plants near flower gardens and do everything possible to eradicate thrips by very frequent spraying with Black Leaf 40 and soap, kerosene emulsion, prepared white spraying oil or some similar contact insecticide. This should be commenced long before any disease appears. Weeds growing along the headlands which may harbour thrips should be destroyed.

All diseased plants should be pulled out and destroyed by burning or boiling as soon as noticed.

A variety grown in the Balcatta area, known variously as "Arbuckles" or "Richters" appears to be somewhat resistant, as does also the "Early Dwarf Red." The "Early Dwarf Red" is the most resistant variety so far grown in this State. On no account should "Dwarf Champion" be grown as this is one of the most easily susceptible. (It is, however, a great favourite with a number of seed merchants and nurserymen, for sale purposes, on account of the sturdy and attractive appearance of the plants in the seedling stage.)

Frequent overhead watering tends to check thrips, but, unfortunately, tends to encourage fungous diseases, so that the more frequently overhead watering is used the more care must be taken to prevent fungal diseases of the foliage by spraying with Bordeaux Mixture or the use of copper-containing dusts.

Fig. 11.—Left: Second stage larva of the "Black Carnation Thrips," *Frankliniella insularis*, one of the two thrips species which are responsible for the natural dissemination of the Spotted Wilt virus.

Middle: Adult female of same species.

Right: Adult male of same species.

The adults are winged but the wings are hardly obvious in the photographs. All much magnified. The actual size of these insects is about 1/25th inch. The other thrips species (*Thrips tabaci*) which transmit Spotted Wilt from diseased to healthy plants is much lighter in colour and less conspicuous than that pictured above.

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A plan which has a good deal to recommend it is to plant out two or three plants at transplanting time in a small triangle at each place where normally only one would be put. This allows of diseased plants being pulled out as soon as noticed without leaving a large number of unsightly gaps through the field. The disease does not spread at all rapidly by contact of diseased with healthy plants.

Tomatoes planted out after Christmas sometimes do not suffer to the same degree from "Spotted Wilt" as those planted earlier.

As indicating the very intimate relationship of the "Spotted Wilt" virus problem to flower gardens, the following facts may be cited. When the writer first went to the Waite Institute, in 1927, to investigate the "Spotted Wilt"

disease it soon became evident that the disease was more serious at the Institute than in many commercial plantings. The Waite experimental plots were immediately adjacent to and partly surrounded by flower gardens.

In 1931 the writer was responsible for the planting of about one-fifth of an acre of tobacco in the experimental plots of the Department of Agriculture in the grounds of Government House, Perth. The plots are separated by a

Fig. 12.—Two "Golden Queen" tomato plants seven weeks after they had first shown the symptoms of "Spotted Wilt," together with two healthy "control" plants of the same age. The infected plants developed the disease as the result of the placing on each of them of three larval thrips taken from naturally infected tomato plants growing in the field. Symptoms first appeared about sixteen days after the thrips were placed on the plants.

All the plants were about four or five inches high when the thrips were placed on the "experimental" plants (positions 1 and 3 reading from the left). Following on the first severe check, the infected plants had made a certain amount of subsequent growth before the taking of the photograph. All the plants had been growing under identical conditions (except that no thrips had been placed on the "controls"), with the "experimental" and "control" plants alternately arranged, as in the photograph, from the commencement of the experiment.

After H. A. Pittman, Journal of the C.S.I.R., November, 1927.

wire-netting fence from the Government nursery, which always contains numerous beds of annual flowers in addition to shrubs, etc. About 35 per cent. of the tobacco plants were wiped out by a virus disease tentatively ascribed to infection with the "Spotted Wilt" of tomato virus. In 1933 tobacco plants were again planted in these plots, and again about 35 per cent. of the plants were killed by the virus disease, the incidence of the disease commencing in

each year shortly after transplanting the seedlings from the seed beds. G. Samuel and J. G. Bald, of the Waite Institute, have just published an article on the "Spotted Wilt" disease of tomato as it affects tobacco in South Australia (7), and their description exactly coincides with the Western Australian tobacco disease and removes all doubt as to the "Spotted Wilt" virus being responsible for the Western Australian disease, which is not known anywhere else in this State than in the neighbourhood of the Government nursery. Commercial tobacco fields in this State are usually planted in forest clearings and are rarely in close proximity to flower gardens. (No attempt was made to prevent thrips attacking the tobacco plants referred to above.)

Fig. 13.—Three "Golden Queen" tomato plants artificially infected with "Spotted Wilt" by means of larval thrips taken from naturally infected tomato plants growing in the field. Three larval thrips were used on each "experimental" plant (positions 1, 3, and 5 reading from left). These plants and their "controls" were from the same experiment as those in Fig. 12, but the photograph was taken ten weeks after symptoms first appeared on the "experimental" plants. Note that under glasshouse conditions and with careful attention the infected plants have made some straggly abnormal growth after their first serious set-back. The diseased plants are without fruit, but some fruit has formed on the three healthy plants, as can be seen on close examination of the centre healthy plant, two trusses being fairly obvious; one near the middle left, and the other towards the top of the plant.

Photo. taken by Author at Waite Institute, 1927.

The problem of virus disease control is complicated by the very disturbing fact that whereas most fungal and bacterial diseases are confined fairly definitely to their own particular hosts and are usually quite unable to attack unrelated species or genera, the viruses show a very marked disinclination to "play fair"; *e.g.*, as just indicated, the "Spotted Wilt" virus may attack many plants quite unrelated to one another.

Two further complications occur. One is that the symptoms in some of these hosts may be quite dissimilar from those on other hosts, so that many persons would never suspect the identity of the causes in each case. The second of these further complications is that certain plant species may actually be heavily infected with viruses, but be quite unaffected in their growth so far as one can tell. These plants act as "masked carriers" in much the same way as certain people may be carriers for the diphtheria germ and yet not suffer from its presence themselves.

Nature has certainly arranged a difficult puzzle for solution in the virus disease problem. Possibly, however, there has been too much concentration on the virus and insufficient on the plant. The road leading to a complete knowledge of the virus appears to widen and become less clearly defined at every step, until eventually it threatens to cover a field as large as space itself. Perhaps the other road leading to a better knowledge of the plant and possible means of increasing its resistance or tolerance will eventually prove more fruitful of good results from the practical point of view. Only time will tell.

In conclusion readers interested in the pursuit of this or any other plant disease subject are advised they have only to communicate with the Plant Pathology Branch of the Department of Agriculture, when every endeavour will be made to assist them in their efforts to prevent nature voraciously consuming, on the one hand, per medium of plant diseases, what, on the other hand, she so lavishly makes available. Fortunately, science has discovered much more in regard to the control of many other types of plant diseases than is at present known about those belonging to the virus group.

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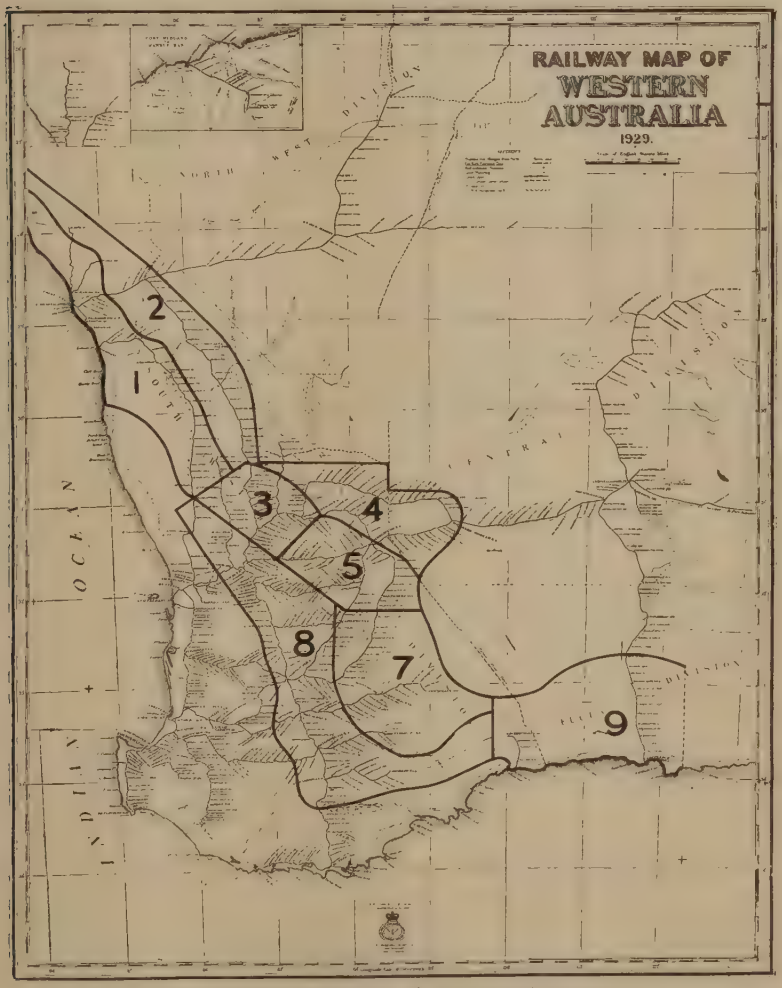
ROYAL AND DISTRICT AGRICULTURAL SOCIETIES' 50-ACRE CROP COMPETITIONS, 1933.

I. Thomas, Superintendent of Wheat Farms.

Entry for these competitions is made through the local Agricultural Societies. These societies organise their own district competitions, the first and second prize winners of which automatically become eligible to compete for the Royal Agricultural Society zone prize. Where the local society does not conduct a com-



Map showing boundaries of the respective zones.

petition, entry is accepted direct with the parent body, the Royal Agricultural Society. In this way no farmer, desirous of doing so, is prevented from participating.

As can be readily understood, there is considerable variation in rainfall, soil, etc., in a wheat belt so widely extended. For these reasons it has been subdivided into eight zones in such a manner that districts having similar interests and climatic conditions have been grouped together. In this way farmers may compete with each other more equitably. The accompanying map shows the eight zones referred to.

In each of these zones a championship prize of £10 and a second prize of £2 10s. are awarded.

In addition to these zone prizes the Royal Agricultural Society each year offers a special prize of £5 5s. to the competitor in any zone obtaining the highest calculated bushel yield per acre.

The conditions of the competitions require that the crop shall be grown on fallowed land, shall not be less than 50 acres in area of one variety, and shall be judged under the following scale of points:—

Yield	50 points.
Freedom from weeds	10 „
Freedom from disease	10 „
Freedom from admixture	15 „
Evenness of growth	15 „
Total	100 points.

The system adopted has been to allot one point for each calculated bushel yield, which is determined not by estimation but upon that calculated from portions of the crop obtained from small areas taken systematically throughout the crop. These samples are then threshed and the grain weighed.

Since the inception of the Royal and District Crop Competitions the judges have been Departmental Officers attached to the Wheat Branch of the Department of Agriculture.

The detailed awards made are as follows:—

ZONE 1.

Judge: G. L. Throssell, Agricultural Adviser.

Three Springs Society, 5 competitors; Carnamah Society, 2 competitors; Total, 7 competitors.

Three Springs Agricultural Society.

The rainfall recorded at Three Springs was as follows:—

——	Jan.	Feb.	Mar.	Apl.	Growing Period. May.	June	July.	Aug.	Sep.	Oct.	Total.	Nov.	Dec.	Total for year.
Three Springs ...	11	3	36	15	306	658	194	258	67	119	1,602	33	21	1,721

The awards made are tabulated hereunder:—

Competitor.	Address.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points.	Total. 100 points.
Carter, H. R. ...	Three Springs	Waratah ...	35	9	8	14	14	80
Lynch, P. J., Senator	do.	Bencubbin ...	31	8	7	14	12	72
Hebiton, J. K. (sen.)	do.	Merredin ...	28	8	9	13	13	71
Evans, R. J. ...	do.	Merredin ...	28	8	8	13	13	70
Hebiton, J. K. (jun.)	do.	Merredin ...	26	8	8	13	13	68

Carnamah Agricultural Society.

The rainfalls recorded at Carnamah and Coorow were as follow:—

——	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June	July.	Aug.	Sep.	Oct.	Total.			
Coorow	6	46	29	26	226	447	172	279	77	102	1,303	18	25	1,453
Carnamah	10	3	46	25	344	628	201	366	76	98	1,713	41	34	1,872

The awards made are tabulated hereunder:—

Competitor.	Address.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points.	Total. 100 points.
Bothe, B. D. ...	Coorow ...	Bencubbin ...	41	8	8	14	13	84
Forrester, J. K. ...	Carnamah ...	Bena ...	27	8	8	13	13	69

ZONE 2.

Judge: G. L. Throssell, Agricultural Adviser.

Only one entry, and that direct with the Royal Agricultural Society, was received for this zone.

The rainfall as recorded at Tenindewa was as follows:—

——	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June	July.	Aug.	Sep.	Oct.	Total.			
Tenindewa	2	...	156	5	224	485	191	218	150	112	1,380	15	35	1,593

The awards made in connection with this entry are as set out below:—

Competitor.	Address.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points.	Total. 100 points.
Moore, Hon. T. ...	Indarra ...	Bencubbin ...	34	9	9	14	13	79

ZONE 3.

Judge: R. W. Prunster, Manager, Yilgarn Experiment Farm.

Dowerin Society, 4 competitors; Royal Agricultural Society, 3 competitors; Total 7 competitors.

Dowerin Agricultural Society.

The rainfalls recorded at Minnivale and Dowerin are as follow:—

——	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June	July.	Aug.	Sep.	Oct.	Total.			
Dowerin	16	84	5	14	168	285	162	240	44	110	1,009	81	10	1,219
Minnivale	12	55	12	12	202	260	161	207	69	152	1,051	134	59	1,335

The awards made are as follow:—

Competitor.	Address.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points.	Freedom from Disease. 10 points.	Freedom from Admixture. 15 points.	Evenness of Growth. 15 points.	Total. 100 points.
Bear, H. E. ...	Minnivale ...	Bencubbin ...	31	8	9	14	14	76
Hughes, J. R. ...	do. ...	do. ...	35	8	9	10	13	75
Anderson, F. ...	Dowerin ...	Pusa ...	30	8	8	13	14	73
Williams, G. ...	Hindmarsh	Waratah ...	27	8	7	14	13	69

Royal Agricultural Society.

The rainfalls as recorded at Goomalling and Wongan Hills are as follow:—

——	Jan.	Feb.	Mar.	Apl.	Growing Period. May.	June	July.	Aug.	Sep.	Oct.	Total.	Nov.	Dec.	Total for year.
Goomalling	21	17	15	9	288	365	168	261	74	132	1,288	30	5	1,385
Wongan Hills ...	12	12	...	8	198	321	195	229	80	113	1,136	51	16	1,235

The awards are as set out below:—

Competitor.	Address.	Society.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points.	Total. 100 points.
Waterhouse, E. J.	Goomalling	Royal ...	Gluclub	37	7	8	13	13	78
Lane Bros. ...	Wongan Hills	do. ...	Nabawa...	28	9	9	14	14	74
Mt. Rupert Co.	do.	do. ...	Merredin	26	9	8	14	14	71

ZONE 4.

Judge: I. Thomas, Superintendent of Wheat Farms.

Mt. Marshall Society, 5 competitors; Mukinbudin-Lake Brown Society, 6 competitors; Southern Cross Society, 3 competitors; Nungarin-Eastern Districts Society, 9 competitors; Total, 23 competitors.

Mt. Marshall Agricultural Society.

The rainfalls as recorded at Bencubbin, Mt. Marshall and Gabbin are as follow:—

——	Jan.	Feb.	Mar.	Apl.	Growing Period. May.	June	July.	Aug.	Sep.	Oct.	Total.	Nov.	Dec.	Total for year.
Bencubbin	2	21	20	7	149	259	127	190	53	84	862	44	49	1,005
Mt. Marshall ...	6	18	18	14	155	286	151	197	55	88	932	78	34	1,100
Gabbin	4	16	39	24	166	293	135	188	61	97	940	87	54	1,164

The awards made are as set out hereunder:—

Competitor.	Address.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points.	Total. 100 points.
Perry Bros. ...	Bencubbin ...	Gluyas Early	29	8	7	13	14	71
Hopwood, B. W. G.	do.	Bencubbin ...	26	9	8	14	13	70
Gilham, F. ...	Marshall Rock	Gluyas Early	25	8	7	13	14	67
Collins, D. W. ...	Bencubbin ...	Nabawa ...	22	8	9	13	13	65
Flitcroft, W. ...	Gabbin ...	Bencubbin ...	22	7	8	13	13	63

Mukinbudin-Lake Brown Agricultural Society.

The rainfalls as recorded at the various centres are as follow:—

	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June	July.	Aug.	Sep.	Oct.	Total.			
Mukinbudin ...	9	36	36	3	105	233	112	156	69	78	753	84	...	921
Wilgoyne	17	47	81	10	144	231	87	148	59	52	721	128	211	1,215
Mangowine	19	33	11	38	96	230	141	161	94	69	791	67	49	1,008

The awards made, including those eligible for the local competition, but whose entry was received too late to participate in the main competition, are as hereunder:—

Competitor.	Address.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points.	Total. 100 points.
Leyland, H. ...	Mukinbudin	Gluyas Early	25	9	8	13	14	69
*Hicks, C. T. ...	Lake Brown	Bencubbin ...	26	8	9	12	13	68
Connor, T., Senr. ...	Wilgoyne ...	Gluyas Early	24	9	7	14	13	67
Williams, T. A. ...	Mangowine	Bencubbin ...	24	7	8	14	13	66
*Maddock, N. ...	Wilgoyne ...	Gluyas Early	21	9	8	14	13	65
Manuel, C. J. ...	Mukinbudin	do.	22	7	7	14	14	64
Shadbolt, H. J. ...	do.	do.	19	7	8	14	12	60
Harris, E. G. S ...	do.	do.	20	7	6	13	14	60
*Maddock, G. ...	Wilgoyne ...	Geeralying ...	19	7	8	11	12	57

* Not eligible to compete for the Royal Agricultural Society's Zone Prize—Entry received too late.

Southern Cross Agricultural Society.

The rainfalls as recorded at the various centres are as follows:—

	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June	July.	Aug.	Sep.	Oct.	Total.			
Yilgarn Experiment Farm (Ghooli) ...	20	...	108	39	211	245	120	193	40	50	859	42	70	1,138
Southern Cross ...	22	7	82	32	196	213	111	202	37	49	808	52	69	1,072

The awards made, in this case also including several who are ineligible for the main competition, are as hereunder:—

Competitor.	Address.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points.	Total. 100 points.
Stevens, G. K. ...	Ghooli ...	Bencubbin ...	25	8	9	14	12	68
*Smith, P. J. ...	Turkey Hill	Noongaar	25	8	8	12	13	66
*Brockway, —. ...	Corinthian ...	Gluyas Early	21	9	8	13	13	64
Davies, J. G. & F.	do.	Noongaar ...	20	7	9	13	13	62
*White, G. (Sen.) ...	Bullfinch ...	Gluyas Early	18	8	8	13	13	60
Dowdall, A. ...	Moorine Rock	do.	18	7	8	12	13	58
*Powell, C. R. ...	do.	do.	17	7	8	13	12	57

*Not eligible to compete for the Royal Agricultural Society's Zone Prize—Entry received too late.

Nungarin-Eastern Districts Agricultural Society.

The rainfalls as recorded at Kwelkan, Nungarin, Nukarni and Yelbeni:—

——	Jan.	Feb.	Mar.	Apl.	Growing Period. May.	June	July.	Aug.	Sep.	Oct.	Total.	Nov.	Dec.	Total for year.
Nungarin	11	4	65	9	119	275	165	157	56	64	836	77	49	1,051
Nukarni	9	...	22	20	125	196	154	195	65	99	834	31	45	961
Yelbeni	15	18	30	17	235	288	159	236	80	93	1,091	88	39	1,298

The awards made are as set out hereunder:—

Competitor.	Address.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points.	Total. 100 points.
Creagh Bros. ...	Kwelkan ...	Bencubbin ...	28	8	9	14	13	72
Jolly, H. P. ...	Nungarin ...	Nabawa ...	24	9	8	14	14	69
Evans, L. D. ...	Nukarni ...	Bencubbin ...	26	7	8	13	13	67
Jolly, J.	Nungarin ...	Geeralying ...	21	9	9	14	14	67
Williams, F. A. ...	do.	Bencubbin ...	24	7	8	14	13	66
Green, T. W. ...	do. ...	Nabawa ...	22	7	8	13	13	63
Gleeson, M. J. ...	Yelbeni ...	Bencubbin ...	22	6	7	14	12	61
Browne, —. ...	Nukarni ...	Gluclub ...	19	9	8	11	13	60
Vernon, G. J. ...	do. ...	Bencubbin ...	18	7	8	14	12	59

ZONE 5.

Judge: R. P. Roberts, Agricultural Adviser.

Merredin Society, 11 competitors; Bruce Rock Society, 11 competitors;

Total, 22 competitors.

Merredin Agricultural Society.

The rainfalls as recorded at the various centres are as follow:—

——	Jan.	Feb.	Mar.	Apl.	Growing Period. May.	June	July.	Aug.	Sep.	Oct.	Total.	Nov.	Dec.	Total for year.
Ulva	27	...	86	8	239	311	170	167	72	144	1,103	44	130	1,398
Nukarni	9	...	22	20	125	196	154	195	65	99	834	31	?	?
Baandee	10	...	62	16	165	248	82	123	59	89	766	23	86	963
Burracoppin ...	11	11	36	20	124	205	132	187	55	63	766	44	45	933
Walgoolan (Kevin Farm)	...	...	33	23	115	262	160	238	55	49	879	?	?	?
Merredin	23	...	19	22	179	248	139	199	63	123	951	50	28	1,093

The awards made are as set out hereunder:—

Competitor.	Address.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points.	Total. 100 points.
Teasdale, F. O. ...	Korbel ...	Bencubbin ...	31	8	8	14	14	75
Teasdale, H. W. ...	Ulva ...	Totadgin ...	31	7	9	12	14	73
Flockart, I. ...	Korbel ...	Geeralying ...	27	8	8	14	14	71
Maughan, T. G. & J.	Nukarni ...	Merredin ...	28	8	8	13	13	70
Kay, J.	Baandee ...	Gluclub ...	31	7	8	10	13	69
Reichelt, E. E. ...	Burracoppin	Bencubbin ...	27	9	9	12	12	69
Barnett, L. T. C....	Walgoolan ...	Gluyas Early	26	8	7	14	13	68
Smallacombe, T. H.	Merredin ...	Merredin ...	26	8	6	13	12	65
Horobin, E. A. & O. W.	Nangeenan	Bencubbin ...	22	8	8	14	10	62
Wahlsten, R. A. ...	Walgoolan ...	Canberra ...	21	9	7	12	12	61
Cockram, H. W. ...	Nukarni ...	Bencubbin ...	22	7	8	13	11	61

Bruce Rock Agricultural Society.

The rainfalls as recorded at the several centres are as follow:—

	Jan.	Feb.	Mar.	Apl.	Growing Period. May.	June	July.	Aug.	Sep.	Oct.	Total.	Nov.	Dec.	Total for year.
Yarding	39	...	13	29	256	224	144	128	48	229	1,029	18	74	1,202
Belka	21	2	34	18	189	228	134	163	102	125	941	42	34	1,092
Babakin	30	...	110	32	239	193	159	168	52	134	915	12	31	1,130
Bruce Rock ...	25	4	34	34	188	211	124	133	87	113	856	29	44	1,026

The awards made are as tabulated hereunder:—

Competitor.	Address.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points.	Total. 100 points.
Farrall, F. C. & Sons	Yarding ...	Gluclub ...	34	9	8	13	14	78
Teasdale Bros. ...	Belka ...	Bencubbin ...	34	8	8	13	14	77
Smith, C. & Sons ...	Yarding ...	Gluclub ...	32	7	9	13	12	73
Buller & Black ...	Babakin ...	do. ...	31	8	8	13	12	72
Stevens, D. ...	Ardath ...	do. ...	31	8	8	12	13	72
Brown, R. H. ...	Bruce Rock	Nabawa ...	28	7	8	13	14	70
Brown, S.	do.	Gluclub ...	27	8	7	13	14	69
Schilling, C. E. & N. S.	do.	Bencubbin ...	28	8	8	13	10	67
Johnson, W. D. ...	do.	Gluclub ...	27	8	7	12	12	66
Perkins, C. C. ...	Belka ...	Bencubbin ...	27	7	8	12	12	66
Pimlott, S. H. ...	Kwolyin ...	Sword ...	26	9	8	11	12	66

ZONE 7.

Judge: A. S. Wild, Agricultural Adviser.

Lake Grace Society, 7 competitors; Harrismith Society, 7 competitors; Karlgarin Society, 12 competitors; Kukerin Society, 12 competitors; Kulin Society, 8 competitors; Total, 46 competitors.

Lake Grace Agricultural Society.

The rainfalls as recorded at Lake Grace, Lake Biddy and Burngup are as follow:—

	Jan.	Feb.	Mar.	Apl.	Growing Period. May.	June	July.	Aug.	Sep.	Oct.	Total.	Nov.	Dec.	Total for year.
Lake Grace	84	11	227	20	173	215	100	99	91	163	841	4	23	1,210
Lake Biddy ...	20	...	136	13	133	303	127	92	?	127	?	40	49	?
Burngup (Dulce) ...	77	6	152	21	222	314	139	131	93	169	1,068	51	125	1,500

The awards made are as set out below:—

Competitor.	Address.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points.	Total. 100 points.
Coad, J.	Lake Grace...	Bencubbin ...	35	9	9	14	13	80
Curwood, W. ...	Lake Biddy	Gluyas Early	22	9	8	13	13	65
Carruthers, H. F. ...	Lake Grace...	Waratah ...	22	8	8	13	13	64
Bishop, H. J. ...	do.	do. ...	23	7	8	13	12	63
Carruthers, R. (jun.)	do.	Gluclub ...	24	8	7	11	13	63
Collinson & Fleay...	Burngup ...	Waratah ...	21	7	7	14	13	62
Tunney Bros. ...	Lake Grace...	Gluclub ...	21	9	7	12	13	62

Harrismith Agricultural Society.

The rainfall as recorded at Tinkurrin is as follows:—

	Jan.	Feb.	Mar.	Apl.	Growing Period. May.	June	July.	Aug.	Sep.	Oct.	Total.	Nov.	Dec.	Total for year.
Tinkurrin (Tovil) ...	130	47	132	36	240	302	159	121	113	138	1,073	5	...	1,423

The awards made are as shown hereunder:—

Competitor.	Address.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points.	Total. 100 points.
McDonald, W. G....	Tinkurrin ...	Bencubbin ...	32	8	9	14	13	76
Murray, A. ...	do. ...	do. ...	31	8	9	13	13	74
Norton, J.... ...	do. ...	Nabawa ...	28	8	9	14	14	73
Parnell, F. G. ...	do. ...	Queen Fan ...	30	8	7	12	13	70
Atsbury & Sons ...	Harrismith	Gluyas Early	23	7	8	13	13	64
Baker Bros. ...	do.	Free Gallipoli	24	8	7	12	12	63
Sukroo, W. P. ...	Tinkurrin ...	Nabawa ...	22	7	7	12	12	60

Karlgarin Agricultural Society.

The rainfalls as recorded at the several centres are as follow:—

	Jan.	Feb.	Mar.	Apl.	Growing Period. May.	June.	July.	Aug.	Sep.	Oct.	Total.	Nov.	Dec.	Total for year.
Karlgarin, East ...	38	12	165	44	187	186	121	177	60	86	817	17	33	1,126
Hyden, South ...	54	5	182	51	202	145	135	160	59	130	831	42	11	1,176
North Hyden (Camel Peak)	87	...	41	48	194	158	153	168	64	168	906	?	?	?

The awards made are as shown hereunder:—

Competitor.	Address.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points.	Total. 100 points.
Grant, L. J. ...	Karlgarin ...	Bencubbin ...	32	9	8	14	14	77
Medcalfe, C. W. ...	do. ...	do. ...	32	8	9	14	13	76
Marshall, H. J. ...	Hyden ...	do. ...	29	9	9	14	14	75
Biglin, E. J. ...	Karlgarin ...	Gluyas Early	32	8	8	13	13	74
James, S. W. ...	do. ...	Bencubbin ...	31	8	8	12	13	72
Shawyer, C. ...	do. ...	do. ...	27	9	8	12	14	70
Biglin, D. A. ...	do. ...	Gluyas Early	26	8	8	13	14	69
Turner, H. E. ...	N. Hyden ...	Gluclub ...	26	9	8	12	14	69
Green & Atkinson	do. ...	Gluyas Early	25	9	8	12	14	68
Clayton, R. G. ...	do. ...	Merredin ...	21	9	7	13	14	64
Mouritz, W. ...	Hyden ...	Gluclub ...	23	8	8	12	13	64
McLennon, A. T. ...	do. ...	Waratah ...	23	8	7	12	13	63

Kukerin Agricultural Society.

The rainfalls as recorded at the respective centres are as follow:—

	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sep.	Oct.	Total.			
Kukerin	147	30	97	34	271	300	125	189	141	248	1,274	10	12	1,604
Moulyinning ...	69	23	79	35	222	254	89	133	92	198	988	3	18	1,215

The awards made are as shown below:—

Competitor.	Address.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points.	Evenness of Growth. 15 points.	Total. 100 points.
English, J. C. ...	South Kukerin	Bencubbin ...	38	9	9	14	14	84
Bahr, E. C. ...	do.	Yandilla King	37	8	8	12	13	78
Pyke, G.	Kukerin ...	Free Gallipoli	33	8	9	13	13	76
Adams, T.	South Kukerin	Nabawa ...	31	9	8	12	13	73
Coates & Son ...	Moulyinning	Gluyas Early	28	9	9	13	14	73
Faulkner, W. J. ...	North Kukerin	Nabawa ...	31	8	9	12	13	73
Smith, A. H. ...	South Kukerin	Gluyas Early	31	7	9	12	14	73
Troup, A.	Kukerin ...	Free Gallipoli	28	9	8	14	13	72
Williams, T. C. ...	South Kukerin	Bencubbin ...	27	8	8	14	13	70
Ditchburn, R. & Son	North Kukerin	Free Gallipoli	24	8	8	13	13	66
Sugg Bros. ...	do.	Nizam ...	24	8	8	12	13	65
Daffor, J.	do.	Bencubbin ...	21	8	8	14	13	64

Kulin Agricultural Society.

The rainfalls as recorded at Kulin, Kulin Rock and Jilakin are as follow:—

	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June.	July	Aug.	Sep.	Oct.	Total.			
Kulin	135	9	170	28	282	264	157	163	71	194	1,131	33	13	1,499
Kulin Rock ...	27	13	160	47	185	208	107	129	65	123	817	46	...	1,110
Jilakin	110	15	174	28	234	254	131	146	94	178	1,037	8	6	1,378

The awards made are tabulated hereunder:—

Competitor.	Address.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points.	Total. 100 points.
Henderson, L. W. ...	Kulin ...	Gluclub ...	39	8	8	12	14	81
Trotter, A. W. ...	do. ...	do. ...	38	8	9	12	13	80
Freebairn, F. S. ...	Jilakin ...	do. ...	35	9	8	12	13	77
Russell & Bailey ...	Kulin Rock	Bencubbin ...	33	8	9	14	13	77
Nichols, R. ...	do.	do. ...	32	8	8	14	14	76
Scadding, N. A. ...	Jilakin ...	Gluclub ...	33	9	8	12	14	76
Meikle, P.	Kulin Rock	Bencubbin ...	29	9	9	14	13	74
Bowey, P. J. ...	Kulin ...	Nabawa ...	28	9	8	13	13	71

ZONE 8.

Judge: N. Davenport, Agricultural Adviser.

Gnowangerup Society, 9 competitors; Wickepin Society, 4 competitors; Royal Agricultural Society, 3 competitors; Total, 16 competitors.

Gnowangerup Agricultural Society.

The rainfalls as recorded at Gnowangerup and Pallinup are as follow:—

	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June	July.	Aug.	Sep.	Oct.	Total.			
Gnowangerup ...	114	11	78	26	154	428	102	121	110	243	1,158	68	51	1,500
Pallinup	55	14	97	54	191	371	141	160	130	232	1,225	?	?	?

The awards made are shown below:—

Competitor.	Address.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points.	Total. 100 points.
Davis, D.	Kebaringup	Bencubbin ...	43	9	9	14	14	89
MacDonald, J. ...	Gnowangerup	do. ...	39	9	9	14	13	84
Cockram, C. ...	Pallinup ...	Yandilla King	39	9	9	14	12	83
Glengarrie Estate ...	Gnowangerup	Bencubbin ...	38	9	9	14	12	82
Garnett, L. T. C. ...	Pallinup ...	Yandilla King	37	8	9	14	12	80
Griffiths, J. ...	Gnowangerup	Bencubbin ...	34	9	9	14	13	79
Taylor, C.	Pallinup ...	Yandilla King	36	8	8	13	13	78
Griffiths, H. ...	Gnowangerup	Bencubbin ...	32	8	8	14	12	76
House, W. L. C. ...	Kebaringup	Free Gallipoli	30	8	9	14	12	73

Wickepin Agricultural Society.

The rainfalls recorded are as follows:—

	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June	July.	Aug.	Sep.	Oct.	Total.			
Wickepin	95	13	154	41	318	338	182	148	106	152	1,244	12	9	1,568
Toolibin (Colunie) ...	182	6	102	29	337	265	105	175	75	158	1,115	13	12	1,459

The awards made are shown below:—

Competitor.	Address.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points.	Total. 100 points.
Hosken Bros. ...	Wickepin ...	Free Gallipoli	30	8	8	14	13	73
Clifford, T. ...	do. ...	Federation ...	26	9	8	13	12	68
Miller, S. H. ...	Toolibin ...	Free Gallipoli	21	8	8	14	12	63
Martin, F. C. ...	Wickepin ...	do.	20	9	8	13	11	61

Royal Agricultural Society.

The rainfalls as recorded at South Caroling and Quairading are as follow:—

	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June	July.	Aug.	Sep.	Oct.	Total.			
South Caroling (Woodstock)	115	2	145	40	196	181	134	110	56	161	838	6	3	1,149
Quairading	47	6	154	34	256	247	172	149	73	107	1,004	11	3	1,319

The awards made are as shown hereunder:—

Competitor.	Address.	Society.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points.	Total. 100 points.
Taylor & Sons	Quairading	Royal ...	Gluclub ...	30	9	9	14	14	76
Lohoar & Sons	do.	do. ...	do.	26	9	9	13	14	71
Richards, A.	South Caroling	do.	do.	27	8	8	14	13	70

ZONE 9.

Judge: J. Langfield, Manager, Merredin Experiment Farm.
Southern Mallee Society, 8 competitors.

Southern Mallee Agricultural Society.

The rainfalls as recorded at the various centres are as follow:—

	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June	July.	Aug.	Sep.	Oct.	Total.			
Grass Patch (East)...	90	1	230	17	143	88	151	115	116	227	840	198	47	1,443
Kumarl	217	..	132	16	93	96	90	83	72	106	540	159	32	1,096
Sunrise Hill (The Grange)	84	...	80	11	97	117	89	103	69	98	573	178	14	940
Salmon Gums ..	201	...	222	12	126	138	139	88	70	126	687	184	26	1,332
Dowak (The Hermitage)	228	...	147	16	136	133	91	116	68	109	653	178	61	1 283

The awards made are as shown hereunder:

Competitor.	Address	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points.	Total. 100 points.
Ritchie, D.... ..	Grass Patch	Nabawa ...	25	8	8	14	13	68
Nulsen & Dunn ..	Kumarl ...	Gluyas Early	17	9	9	14	14	63
Salmon, W. ..	Sunrise Hill	do.	16	9	9	14	14	62
Johnston, J. F. ...	West Dowak	do.	13	8	9	14	12	56
Barry, T.	do.	do.	13	9	9	12	13	56
Morton, N. R. ...	Sunrise Hill	Nabawa ...	13	8	9	12	13	55
Thomas Bros. .	Salmon Gums	do. ...	11	8	9	12	13	53
Chapman, F. .	Dowak ...	Gluyas Early	8	7	8	13	12	48

ROYAL AGRICULTURAL SOCIETY—ZONE CHAMPIONSHIP AWARDS.

Representatives from District Agricultural Societies' Competitions and Entries received direct by the Royal Agricultural Society.

Competitor.	Address.	Society.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points.	Total. 100 points.
ZONE 1.—Judge: G. L. Throssell, Agricultural Adviser.									
Bothe, B. D.	Coorow ...	Carnamah	Bencubbin	41	8	8	14	13	84
Carter, H. R.	Three Springs	Three Springs	Waratah	35	9	8	14	14	80
Lynch, P. J., Senator	do.	do.	Bencubbin	31	8	7	14	12	72
Forrester, J. K.	Carnamah	Carnamah	Bena ...	27	8	8	13	13	69
ZONE 2.—Judge: G. L. Throssell, Agricultural Adviser.									
Moore, Hon. T.	Indarra ...	Royal ...	Bencubbin	34	9	9	14	13	79
ZONE 3.—Judge: R. W. Prunster, Manager, Yilgarn Experiment Farm.									
Waterhouse, E. J.	Goomalling	Royal ...	Gluclub ...	37	7	8	13	13	78
Bear, H. E.	Minnivale ...	Dowerin	Bencubbin	31	8	9	14	14	76
Hughes, J. R.	do.	do.	do.	35	8	9	10	13	75
Lane Bros. ...	Wongan Hills	Royal ...	Nabawa	28	9	9	14	14	74
Mt. Rupert Co.	do.	do.	Merredin	26	9	8	14	14	71
ZONE 4.—Judge: I. Thomas, Superintendent of Wheat Farms.									
Creagh Bros.	Kwelkan ...	Nungarin	Bencubbin	28	8	9	14	13	72
Perry Bros.	Bencubbin	Mt. Marshall	Gluyas Early	29	8	7	13	14	71
Hopwood, B. W. G.	do.	do.	Bencubbin	26	9	8	14	13	70
Jolly, H. P.	Nungarin ...	Nungarin	Nabawa	24	9	8	14	14	69
Leyland, H.	Mukinbudin	Mukinbudin-Lake Brown	Gluyas Early	25	9	8	13	14	69
Stevens, G. K.	S. Ghooli ...	Southern Cross	Bencubbin	25	8	9	14	12	68
Connor, T. ...	Mukinbudin	Mukinbudin-Lake Brown	Gluyas Early	24	9	7	14	13	67
Davies, J. G. & F.	Southern Cross	Southern Cross	Noongaar	20	7	9	13	13	62
ZONE 5.—Judge: R. P. Roberts, Agricultural Adviser.									
Farrell, F. C. & Sons	Bruce Rock	Bruce Rock	Gluclub	34	9	8	13	14	78
Teasdale Bros.	Belka ...	Bruce Rock	Bencubbin	34	8	8	13	14	77
Teasdale, F. O.	Korbel ...	Merredin	do.	31	8	8	14	14	75
Teasdale, H. W.	Ulva ...	do.	Totadgin	31	7	8	12	14	73
ZONE 7.—Judge: A. S. Wild, Agricultural Adviser.									
English, J. C.	S. Kukerin	Kukerin	Bencubbin	38	9	9	14	14	84
Henderson, L. W.	Kulin ...	Kulin ...	Gluclub ...	39	8	8	12	14	81
Coad, J. ...	Lake Grace	Lake Grace	Bencubbin	35	9	9	14	13	80
Trotter, A. W.	Kulin ...	Kulin ...	Gluclub ...	38	8	9	12	13	80
Bahr, E. O.	S. Kukerin	Kukerin	Yandilla King	37	8	8	12	13	78
Grant, L. J.	Karlgarin ...	Karlgarin	Bencubbin	32	9	8	14	14	77
McDonald, W. G.	Tinkurrin ...	Harrismith	do.	32	8	9	14	13	76
Medcalfe, C. W.	Karlgarin ...	Karlgarin	do.	32	8	9	14	13	76
Murray, A. ...	Tinkurrin ...	Harrismith	do.	31	8	9	13	13	74
Curwood, W.	Lake Biddy	Lake Grace	Gluyas Early	22	9	8	13	13	65

ZONE CHAMPIONSHIP AWARDS—*continued.*

Competitor.	Address.	Society.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points.	Total. 100 points.
Zone 8.—Judge: N. Davenport, Agricultural Adviser.									
Davis, D. ...	Kebaringup	Gnowangerup	Bencubbin	43	9	9	14	14	89
MacDonald, J.	Gnowangerup	do.	do.	39	9	9	14	13	84
Taylor & Sons	Quairading	Royal ...	Gluclub ...	30	9	9	14	14	76
Hosken Bros.	Wickepin ...	Wickepin	Free Gallipoli	30	9	8	14	13	73
Lohoar & Sons	Quairading	Royal ...	Gluclub ...	26	9	9	13	14	71
Richards, A.	S. Caroling	do. ...	do.	27	8	8	14	13	70
Clifford, T. ...	Wickepin ...	Wickepin	Federation	26	9	8	13	12	68
Zone 9.—Judge: J. Langfield, Manager, Merredin Experiment Farm.									
Ritchie, D. ...	Grass Patch	Southern Mallee	Nabawa	25	8	8	14	13	68
Nulsen & Dunn	Kumarl ...	do.	Gluyas Early	17	9	9	14	14	63

OBJECTS OF THE COMPETITION.

This competition was instituted with the object of improving the methods of general farming practised throughout the wheat belt. A spirit of healthy rivalry is engendered and competitors and others set themselves to follow those more successful than themselves. It is demonstrated that where recommended methods are employed, reasonable success follows.

THE SEASON.

The opening of the past season was an unfavourable one. Scattered rains occurred during March, but only in a few districts was it possible to commence active cultural operations in readiness for seeding.

No further rains of consequence fell until towards the end of May, with the result that seeding was generally much delayed.

Further copious falls until the end of June gave rise to excessive wet conditions which interfered with the destruction of weed growth and retarded seeding operations. Crops sown prior to the rain generally suffered much more from weed growth than those sown after it.

July rains were in most instances below the average, but the crops did not appear to be affected by lack of moisture. Rainfall registrations for the following month were above the average. The crops at this stage were backward, but with the advent of warmer weather and ample moisture at this period their growth increased considerably. Timely falls and suitable growing weather, except for a short period of hot weather and drying winds, occurred from then to maturity. The comparative late finishing of the season partly compensated for the late opening, but weed growth took its toll, from the earlier sown crops in particular.

Although frosts occurred in most districts, their intensity was not so marked as in previous years and comparatively little damage resulted.

ENTRIES.

Entries were received from 17 District Agricultural Societies and seven entries were received direct by the Royal Agricultural Society. In addition to these main

competitions, local competitions were held by the Kirwan and Wialki-Bonnie Rock Settlers' Associations and by the Bruce Rock and Phillips River Agricultural Societies. These local competitions included 28 competitors. Included in the competitions for Zone 4 were seven competitors who were eligible for the local but not for the main competition. In all, this was a total of 165 crops inspected, a decrease of 22 from last year.

The following table shows the progress of the competition since its inception in 1921:—

Year.	Number of District Agricultural Societies competing.	Number of Competitors.	Average Yield of Competitors.	Average Yield for State.
			bush.	bush.
1921	...	15	25	10·4
1922	...	32	24	8·9
1923	12	82	29	11·4
1924	15	70	31	12·8
1925	13	59	22·5	9·7
1926	11	99	24·5	12·0
1927	10	100	26·9	12·1
1928	13	114	22·5	10·1
1929	12	156	21·7	11·0
1930	15	165	27·4	13·3
1931	13	110	27·4	13·1
1932	17	168	29·3	12·3
1933	17	130	27·2	11·2*

* Estimate. District Agricultural Societies did not compete until 1923.

YIELDS.

To the competitor who obtains the highest calculated yield per acre from the competing area the Royal Agricultural Society has, since 1925, awarded a special prize of £5 5s.

The prize this year was won by Mr. D. Davis, of Gnowangerup, with a yield of 43 bushels per acre with the variety "Bencubbin."

The winners of the prize to date are:—

	Bus./Acre.
1925—Hebiton & Sons, Three Springs, "Nabawa" ..	34
1926—Cuming Bros., Carnamah, "Yandilla King" ..	38
1927—A. W. Parkinson, Gnowangerup, "Yandilla King"	40
1928—A. W. Parkinson, Gnowangerup, "Yandilla King"	40
1929—C. E. Cockram, Pallinup, "Yandilla King" ..	46
1930—C. Smith & Sons, Yarding, "Gluclub"	43
1931—H. O. Beeck, Gnowangerup, "Yandilla King" ..	42
1932—F. S. Freebairn, Jilakin, "Gluclub"	47
1933—D. Davis, Gnowangerup, "Bencubbin"	43

This year 87, or 67 per cent. of the crops were calculated to yield 25 bushels or over per acre, 47 or 36 per cent. to yield 30 bushels or over, and 16 or 12 per cent. to yield 35 bushels or over. The corresponding percentages last year were 80 per cent., 43 per cent., and 21 per cent. respectively.

These comparative percentage figures indicate the adverse effect of the season on higher yields as the methods employed by the competitors were quite up to the standard of last year.

Those competitors obtaining 35 bushels or over are as tabulated below:—

Zone.	Competitor.	District.	Society.	Variety.	Yield.
					bus.
8	Davis, D.	Kebaringup ...	Gnowangerup ...	Bencubbin	43
1	Bothe, B. D. ...	Coorow	Carnamah	Bencubbin	41
8	Cockram, C. E. ...	Pallinup	Gnowangerup ...	Yandilla King ...	39
7	Henderson, L. W.	Kulin	Kulin	Gluclub	39
8	MacDonald, J. ...	Gnowangerup ...	Gnowangerup ...	Bencubbin	39
7	English, J. C. ...	South Kukerin ...	Kukerin	do.	38
8	Glengarrie Estate ...	Gnowangerup ...	Gnowangerup ...	do.	38
7	Trotter, A. W. ...	Kulin	Kulin	Gluclub	38
7	Bahr, E. O. ...	South Kukerin ...	Kukerin	Yandilla King ...	37
8	Garnett, L. T. C.	Pallinup	Gnowangerup ...	do. ...	37
3	Waterhouse, E. J.	Goomalling ...	Royal	Gluclub	37
8	Taylor, C.	Pallinup	Gnowangerup ...	Yandilla King ...	36
1	Carter, H. R. ...	Three Springs ...	Three Springs ...	Waratah	35
7	Coad, J.	Lake Grace ...	Lake Grace ...	Bencubbin	35
7	Freebairn, F. S. ...	Jilakin	Kulin	Gluclub	35
3	Hughes, J. R. ...	Minnivale	Dowerin	Bencubbin	35

The average calculated yield for all crops inspected was 27.2 bushels per acre.

The following table shows the comparison between the yield for the 1933 season and the previous five years:—

Zone.	Number of Competitors, 1933.	Average Calculated Yield.					
		1933.	1932.	1931.	1930.	1929.	1928.
1	7	30·9	32·1	33·5	28·2	24·7	29·0
2	1	34·0	33·4	26·0	27·6	22·5	19·3
3	7	30·6	34·5	32·5	27·5	23·4	21·3
4	23	22·8	22·8	25·2	26·1	18·2	18·3
5	22	28·0	31·3	28·0	32·7	21·9	20·4
7	46	28·4	29·8	21·8	28·6	22·0	23·0
8	16	31·7	32·8	31·9	30·0	32·2	31·0
9	8	14·5	24·3	23·3	19·8	14·5	...
Yearly figures ...	130	27·2	29·3	27·4	27·4	21·7	22·5

LOCAL CROP COMPETITIONS, 1933.

I. THOMAS, Superintendent of Wheat Farms.

For the past several years, in addition to the 50 acre crop competitions conducted by the Royal and District Agricultural Societies, other competitions were conducted by unaffiliated bodies or by agricultural societies who conducted competitions additional to those in connection with the parent body.

The District Agricultural Society of Bruce Rock conducted a 50 acre crop and fallow competition, and that of Phillips River a 50 acre crop competition.

The competition for the Bevan trophy was continued for another year by the Wialki-Bonnie Rock Settlers' Association, the condition being imposed for the first time that all competing crops should be grown on fallow.

The Kirwan Agricultural Bureau also conducted a 50 acre crop competition under the same conditions as govern the Royal Agricultural Society's competition although not affiliated with it.

The competitors for the above competitions totalled 32, and the average yield was 20.2 bushels per acre.

The following are the particulars of the respective competitions:—

BRUCE ROCK AGRICULTURAL SOCIETY.

Judge: R. P. Roberts, Agricultural Adviser.

The above society commenced a fallow and crop competition in 1932 for which there were five entries, the report on which appeared on page 234 of the June, 1933, issue of the *Agricultural Journal*.

In continuation of this competition crops were planted on the fallow so entered.

The combined awards made by the judge for both sections were as follow:—

Competitor.	Address.	Variety.	Yield. 50 points	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points	Total. 100 points	Fallow. 100 points.	Total, Crop and Fallow 200 points.
Farrall, F. C. & Sons	Yarding...	Gluclub ...	34	9	8	13	14	78	84	162
Pimlott, S. H.	Kwolyin	Sword ...	26	9	8	11	12	66	90	156
Brown, S. ...	Bruce Rock	Gluclub ...	27	8	7	13	14	69	85	154
Smith, C. & Sons	Yarding	do.	31	6	7	13	13	70	82	152
Smith, C. & A. H.	Yalbarrin	do.	23	7	8	13	13	64	86	150

The rainfall as recorded at Bruce Rock was as follows:—

	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June	July.	Aug.	Sept.	Oct.	Total.			
Bruce Rock ...	25	4	34	34	188	211	124	133	87	113	856	29	44	1,026

Phillips River Agricultural Society.

Judge: A. S. Wild, Agricultural Adviser.

The rainfall as recorded at Ravensthorpe was as follows:—

	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June	July.	Aug.	Sept.	Oct.	Total.			
Ravensthorpe ...	86	...	247	12	162	156	68	189	104	164	843	132	109	1,429

The awards made were as set out below:—

Competitor.	Address.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points.	Total. 100 points.
McCulloch, J. ...	Ravensthorpe	Gluyas Early	23	9	9	13	13	67
Campbell, J. ...	Mt. Short ...	do.	21	9	9	14	13	66
Bebbington Bros. ...	do. ...	do.	20	9	9	14	13	65
Chambers Bros. ...	Ravensthorpe	Merredin ...	22	9	8	13	13	65
Barrett Bros. ...	do..	Gluyas Early	19	9	9	14	13	64
Moir, M.	Kaybalup ...	Ford ...	21	9	8	12	14	64

Wialki-Bonnie Rock Settlers' Association.

Judge: N. Davenport, Agricultural Adviser.

The rainfalls as recorded at Wialki, Bonnie Rock, Karloning, and North Wialki are as follows:—

	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June	July.	Aug.	Sept.	Oct.	Total.			
Wialki	12	79	114	20	208	359	136	223	50	64	1,040	?	?	?
Bonnie Rock ...	22	72	116	19	160	310	99	145	51	103	868	71	79	1,247
Karloning	...	88	81	16	144	287	90	169	48	90	828	81	?	?
North Wialki ...	18	133	80	12	248	382	134	178	59	105	1,106	2	126	1,477

The awards made are as shown below:—

Competitor.	Address.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points.	Total. 100 points.
Chamberlain & Pratt	North Wialki	Gluyas Early	23	9	9	14	14	69
Fuss, K.	Bonnie Rock	do.	22	9	9	14	14	68
Jackman, R. C. ...	do.	Bencubbin ...	22	9	9	14	13	67
Freedman, L. F. ...	do.	Gluyas Early	20	9	9	13	14	65
Hurt, W.	Wialki ...	Bencubbin ...	20	9	9	13	13	64
Richardson Bros. ...	Jouerdine ...	do.	19	8	9	13	13	62
Simpson, W. G. ...	N. Dalgouring	Gluyas Early	19	8	9	14	12	62
Dyer, F.	Wialki ...	Noongaar ...	16	9	9	13	13	60
O'Neill, J. H. ...	do.	Gluyas Early	17	8	8	14	13	60
Gale, S.	Bonnie Rock	do.	16	8	9	14	12	59
Smith, E.	Wialki ...	do.	16	8	9	13	13	59
Borlase, J. ...	Karloning ...	do.	16	9	9	12	12	58
Irvine, L.	do.	Bencubbin ...	14	9	9	14	12	58
Gaffin, N. S. ...	Bonnie Rock	Gluyas Early	15	8	9	13	12	57

Kirwan Agricultural Bureau.

Judge: N. Davenport, Agricultural Adviser.

The rainfall as recorded at Kulja is as follows, those for Kokardine are not available:—

	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June	July.	Aug.	Sept.	Oct.	Total.			
Kulja	...	8	76	15	179	389	134	246	30	70	1.048	60	20	1,227

The following table shows the awards made:—

Competitor.	Address.	Variety.	Yield. 50 points.	Freedom from Weeds. 10 points	Freedom from Disease. 10 points	Freedom from Admixture. 15 points	Evenness of Growth. 15 points.	Total. 100 points.
Clover, H. G. ...	Kulja ...	Nabawa ...	20	9	9	14	13	65
Joynes, M. A. & G.	Kokardine ...	Merredin ...	20	7	9	13	13	62
Mitchell, J. A. & H. S.	Kirwan ...	Bencubbin ...	17	8	9	14	13	61
Montegu, J. S. ...	Koorda ...	Waratah ...	17	8	8	13	13	59
Strahan Bros. ...	Kulja ...	Gluyas Improved	20	7	7	13	12	59
Stanwix, E. S. ...	Kokerdine ...	Gluyas Early	18	7	8	13	12	58
Leach, J. R. ...	Kulja ...	Merredin ...	13	6	9	13	10	51

DROOPING FLOWERED CLOVER SEED.

G. R. W. Meadly, B.Sc., Botanical Branch.

Drooping Flowered Clover (*Trifolium cernuum*) is now one of the most useful annual clovers grown in Western Australia and consequently seed production, which commercially is only carried out locally, is of considerable importance.

Glancing through the average purity figures for a number of years it is quite evident that decided efforts are being made by producers to improve the quality of the seed. During the 1929/30 season the average purity was 69.2 per cent. This was followed in 1930/31 by 79.0 per cent.; 1931/32, 90.8 per cent.; and 1932/33, 92.7 per cent. Although the purity figure has increased annually there has been a corresponding, but in no way connected, decrease in germination. As far as our present knowledge holds this decline in germination cannot be countered during the growing stages, but fortunately the seed has definitely responded to treatment as shown by articles in issues of this "Journal." The treatment carried out with the Ames' hulling and scarifying machine has proved most successful, and farmers are definitely advised to purchase only scarified seed. The following table sets out clearly the position regarding Drooping Flowered Clover seed during the last few years.

Season.	Purity Average.	Germination.						Hard Seeds.	
		Average.		Highest.		Lowest.			
		Untreated.	Scarified.	Untreated.	Scarified.	Untreated.	Scarified.	Untreated.	Scarified.
1929–30 ...	69·2	31	...	40	...	24	...	66	...
1930–31 ...	79·0	39	...	39	...	39	...	60	...
1931–32 ...	90·8	6	40	15	47	0	31	94	59
1932–33 ...	92·7	5	51	15	63	1	35	93	47

In order to ascertain whether the germination figure for this season's seed was still low, a number of samples were secured from farmers and the results of tests tabulated as shown below:—

Sample.	Remarks.	Germination.	Hard Seed.
		%	%
A	Hand cleaned	3	96
B	Machine dressed	16	83
C	Hand cleaned	4	95
D	Machine dressed	4	95
E	do.	4	96
F	do.	2	97
G	Hand cleaned	1	98

Sample B was obtained from the same source as Sample A, and the results indicate that the machine used for cleaning had a mild scarifying effect on the seed, thus increasing the germination. Samples C, D and E were all obtained from another source, however, and show no difference between hand-cleaned and machine-dressed seed. One point is very evident from the above tests, viz., the germination of Drooping Flowered Clover seed is low again this season with a corresponding high "hard seed" content. The average germination of the seven samples is 5 per cent. with a "hard seed" content of 94 per cent.

The following table summarises the main results secured with the Ames hulling and scarifying machine during the past season (1932-33) :—

Sample	Weight.		Germination.		Hard Seeds.	
	Before Scarifying.	After Scarifying.	Before Scarifying.	After Scarifying.	Before Scarifying.	After Scarifying.
	lbs.	lbs.	%	%	%	%
1	2,934	2,928	9	35	90	64
2	1,652	1,652	9	36	90	63
3	2,804	2,755	7	44	92	55
4	69	...	15	58	84	42
5	43	...	11	57	89	43

There was practically no loss of seed during the process as the machine is mounted on a concrete floor from which any spilt seed may be easily gathered. The loss in Sample 3 may be definitely attributed to dirty seed which it was found necessary to sieve before treating. This, together with the dust blown out during scarifying accounts for the comparatively large difference in weights.

With last season's averages of 5 per cent. and 51 per cent. for untreated and treated seed respectively, approximately 10 lbs. of untreated seed would be required to produce the immediate stand obtained from 1 lb. of scarified seed. Considering the price of Drooping Flowered Clover to be 2s. 6d. per lb., and taking into account the 3d. per lb. for scarifying, the respective costs for obtaining the same immediate stand would be 25s. and 2s. 9d.

Scarified Drooping Flowered Clover seed may be purchased from a number of local seed merchants, or the seed will be treated by the Department of Agriculture at a charge of 3d. per lb. Seed for treatment should be consigned to the Public Works Department, George Street, Perth, and notification forwarded to the Government Botanist, Department of Agriculture.

PRODUCTION OF "BANYULE SILVERMINE 55th" (25,473).

JERSEY RECORD FOR WESTERN AUSTRALIA.

G. K. Baron-Hay,
Superintendent of Dairying.

The Jersey cow "Banyule Silvermine 55th" (25,473), owned by the Sabina Vale Stud Farm, Wonnerup, by producing 10,887 lbs. milk and 660.55 lbs. butter fat in 273 days has created a new record for the Senior 4-year-old Class and for the Jersey breed in Western Australia.

Previous to this record, pride of place in this class for all breeds was held by the Australian Illawarra Shorthorn cow "Hope 3rd of the Hill" owned by Mr. W. G. Burges, "Tipperary," York, and which produced 13,423 lbs. milk and 606 lbs. butter fat in 273 days, the best Jersey yield in this class having been recorded by "Mokine Empire Lily 6th," owned by Mr. T. H. Wilding. "Mokine Empire Lily 6th," with a production of 9,652 lbs. milk and 591.49 lbs. butter fat as a Senior 4-year-old, still holds pride of place for cows bred in Western Australia.

In producing 660.55 lbs. butter fat in 273 days, "Banyule Silvermine 55th" also now holds the honour of being the highest producing Jersey cow in this State—a title held by the cow "Carnation of Dardanup" since 1923, then owned by Mr. R. H. Rose. "Carnation of Dardanup" produced 10,788 lbs. milk and 660.99 lbs. butter fat in 273 days.

Banyule Silvermine 55th.

The monthly yields of "Banyule Silvermine 55th" are shown hereunder: —

"Banyule Silvermine 55th" (25,473).

Date of Birth: 2nd August, 1928. Date of Calving: 25th May, 1933.

Standard: 330 lbs. Butter Fat in 273 days.

Monthly Production.

	Sub-Period.	Milk.	Butter Fat.	Herd Recorder.
	lb.	lb.	lb.	
June	30 days	1,455	93·90	G. Ruthven
July	30 „	1,320	88·65	L. C. Snook
August	30 „	1,200	83·40	C. Giles
September	30 „	1,125	59·28	L. C. Snook
October	30 „	1,170	62·55	C. Giles
November	30 „	1,245	69·27	C. Giles
December	30 „	1,170	67·98	C. Giles
January	30 „	1,080	66·72	C. Giles
February	33 „	1,122	68·80	L. C. Snook
Total	273 days	10,887	660·55	

Average Test 6·07 per cent.

For record purposes and the information of breeders, Table 1 sets out the highest producing cows in each class to February 28th, 1934, both for locally bred cows and including imported cows.

It will be noticed in Table 2 that the Jersey breed holds the highest records in all classes—except the Junior 2-year-old—for cows bred in Western Australia.

The monthly fodder consumed by "Banyule Silvermine 55th," together with the cost of feeding during the test period, is given in another article appearing in this issue of the "Journal," entitled "The Feeding of Concentrates to High Producing Cows under Test is Profitable."

TABLE 1.—BEST PRODUCING COWS IN EACH CLASS—PURE BRED HERD TESTING SCHEME TO 28TH FEBRUARY, 1934.

Class.	Name of Cow.	Breed.	Age.		Milk.	Average Test.	Butter Fat.	Owner.
					273 DAY TEST.			
			Yrs.	Mths.	lb.	%	lb.	
Mature	Picton's Frequean Flirt	Guernsey	6	1	13,452	5·18	697·98	A. W. Padbury
Senior 4 years	Banyule Silvermine 55th	Jersey ...	4	9	10,887	6·07	660·55	Sabina Vale Stud Farm
Junior 4 years	Lady Fobes Veeman	Friesian	4	5	16,393	3·17	524·88	A. L. B. Lefroy
Senior 3 years	Mokine Empire Lily 7th	Jersey ...	3	11	10,164	5·69	579·11	T. H. Wilding
Junior 3 years	Kitty 8th of Kurrawong	A.I.S. ...	3	4	9,814	4·82	473·26	W. G. Burges
Senior 2 years	Jean 2nd of Grass Vale	Jersey ...	2	9	8,701	5·84	508·93	R. H. Rose
Junior 2 years	Koogan Bo-Peep ...	Guernsey	2	1	6,759	5·77	390·15	A. W. Padbury
					365 DAY TEST.			
Mature ...	Picton's Frequean Flirt	Guernsey	6	1	16,675	5·21	870·06	A. W. Padbury
Senior 4 years	Koogan Dulcie ...	Guernsey	4	10	12,782	5·79	740·81	A. W. Padbury
Junior 4 years	Lady Fobes Veeman	Friesian	4	5	20,139	3·28	660·24	A. L. B. Lefroy
Senior 3 years	Mokine Empire Lily 7th	Jersey ...	3	11	12,815	5·83	747·40	T. H. Wilding
Junior 3 years	Girlie of Sarnia ...	Jersey	3	5	10,843	4·90	520·68	D. Malcolm
Senior 2 years	Jean 2nd of Grass Vale	Jersey ...	2	9	11,181	6·04	676·22	R. H. Rose
Junior 2 years	Lady Fowler 14th of Grass Vale	Jersey ...	1	11	9,365	5·57	521·86	R. H. Rose

TABLE 2.—HIGHEST RECORDS FOR COWS BRED IN WESTERN AUSTRALIA

273 DAY TEST.

Class.	Name of Cow.	Breed.	Milk.	Average Test.	Butter Fat	Owner at time of Test.
			lb.	%	lb.	
Mature ...	Carnation of Dardanup ...	Jersey ...	10,788	5·57	600·99	R. H. Rose
Senior 4 years	Mokine Empire Lily 6th ...	Jersey ...	9,652	6·12	591·49	T. H. Wilding
Junior 4 years	Telvarup Duchess ...	A.I.S. ...	13,792	3·8	522·84	A. E. Grant
Senior 3 years	Mokine Empire Lily 7th...	Jersey ...	10,164	5·69	579·11	T. H. Wilding
Junior 3 years	Lily of Grass Vale ...	Jersey ...	8,772	5·03	442·87	R. H. Rose
Senior 2 years	Jean 2nd of Grass Vale ...	Jersey ...	8,701	5·84	508·93	R. H. Rose
Junior 2 years	Koogan Bo-Peep	Guernsey	6,759	5·77	390·15	A. W. Padbury

Tattoo No. 633L

Breed: Jersey

Name: Banyule Silvermine 55th (25473)

Owner's Name: West Australian Government

Age: Born 2nd August, 1928

Bred by C. Gordon Lyon, Heidelberg

Address: Victoria

Sire: Air Lord of Banyule (3337)

Bred by C. G. Lyon, Victoria

G. Sire: Wotton Airman (Imp.) (2716)

G.G. Sire: Red Cloud (11818), E.J.H.B.

G.G. Dam: Dairymaid, Vol. 26

	Milk. lb.	Av. Test. %	B. Fat.	Days.
Average Produced 8,000 for 5 years.				

G. Dam: Molly 6th of Banyule (7124)

G.G. Sire: Audrey's Lord Twylish (985)

G.G. Dam: Molly 4th of Banyule (4246)

	Milk. lb.	Av. Test. %	B. Fat. lb.	Days.
Produced	12,497	4·9	613	...
5 years av.	10,416	...	487	...
Produced	9.966	5·0	505	...

Dam: Silvermine 25th of Banyule (11602)

Bred by C. G. Lyon, Victoria

	Milk.	Av. Test	B. Fat.	Days.
Produced	5,347	5·96	318	Jnr. 2 yr.
	6.678	6·04	403	Jnr. 3 yr.
	7.070	5·59	395	Mature
	7,388	5·58	412	do.

G. Sire: Lily 3rd's Prince of Ferntree-Vale (1900)

G.G. Sire: Pearl's Prince of Holmwood (986)

G.G. Dam: Lily 3rd of Holmwood (5146)

	Milk. lb.	Av. Test. %	B. Fat.	Days.
Produced	...	...	...	...

G. Dam: Silvermine 20th of Banyule (7131)

G.G. Sire: Mabel's Chief (Imp.) (623).

G.G. Dam: Silvermine 3rd (715)

	Milk. lbs.	Av. Test. %	B. Fat. lbs.	Days.
Produced	6.374	5·81	370	Jnr. 2 yr.
	6.443	5·9	380	
Produced	8,266	5·16	426	

SPECIES TRIALS FOR NEW IRRIGATION AREAS.

T. C. Dunne, H. K. Gibsone and G. Gauntlett.

The extension of irrigation in the South-West will, to some degree, bring under more intensive cultivation, areas of second class clay land which have previously neither received much cultivation nor have carried much pasture. Prior to the extension of drainage, these areas were waterlogged throughout the winter. The fertility of these soils is generally low.

During past years subterranean clover has improved the fertility of many originally similar areas in the South-West. However, in order to utilise the irrigation water provided, it is necessary to establish on unimproved land, pastures which are able to respond to application of water under these low fertility conditions and thereby make the use of water immediately profitable.

For this purpose a trial was conducted to determine species capable of giving satisfactory returns when established with a minimum of soil cultivation. The effects of a number of fertiliser mixtures was also investigated.

An area was selected at Wokalup for this trial. In its virgin state the land carried red gum, blue gum and blackboy and it was cut up by numerous crab holes and clay pans. The site for the trial had been cleared for some years previously. No sown pasture existed and the cover consisted mainly of sedges, silver grass and Guildford grass.

In preparation for the experiment the native growth was burned and a number of ant hills were broken down. Furrows were ploughed out for the purposes of irrigation and drainage. These led into a winter drain dug at one end of the plots. The area was cultivated twice each way with a spike harrow, but penetration was poor.

The area sown to each species was 15 links by 150 links. This was subdivided by the fertiliser treatments. The whole area of the trial covered just over half an acre. With the exception of paspalum, the seeds were sown on May 11, 1932, and the fertiliser applied at the same time. Paspalum was sown after watering in November, 1932. The fertiliser applications were subsequently repeated in the spring and autumn.

The species sown included the following, viz., strawberry clover, white clover, red clover, *Phalaris tuberosa*, perennial rye grass, Italian rye grass, tall fescue, meadow fescue, Kentucky blue grass, timothy, cocksfoot, meadow foxtail, and paspalum. In addition, the annual drooping-flowered clover was sown over the whole area.

The fertiliser treatments were: (a) Super, (b) Super, ammonia, (c) Super, ammonia, lime, (d) Super, ammonia, potash, (e) Super, potash.

With the exception of white and drooping-flowered clovers, the germination was poor, probably due to the fact that the soil had not been sufficiently disturbed for the covering of the seeds. The germination was best on the soil turned out of the irrigation furrows and where ant hills had been broken down. The month following sowing was very wet and cold. Growth generally was poor and, on the plots receiving ammonia, silver grass, which was considerably stimulated by the fertiliser had a very adverse competitive effect.

The first grazing was done in October 1932, and the next in February, 1933. Thereafter the stock (cows) were admitted more frequently and the plots were always heavily grazed with a view to cleaning up the natural species.

No attempt will be made to describe the response to the conditions of all the species. Attention will be given only to those plants which were most successful and which appear to be the most promising for similar areas.

New Zealand white clover was undoubtedly the most outstanding species sown. It responded particularly well to the first watering given in November, 1932, and thereafter spread rapidly. It was always the first species grazed by the stock and was usually eaten until only the runners remained. After grazing it made very rapid recovery and continued to spread until not only had it covered the area where sown but had, by means of runners, spread some distance into neighbouring plots. Not only did it provide feed during most of the year but the clover will undoubtedly cause a big improvement in the fertility and physical condition of the soil. The natural species (sedges, etc.) almost entirely disappeared on the white clover plots owing to the persistent grazing by the stock.

The annual drooping-flowered clover served its purpose of providing late winter and spring feed and thrived in the wet patches. This clover makes, of course, no summer growth.

Red clover did fairly well but, not being able to spread by means of runners like white clover, the poor germination prevented good yields.

Paspalum, though sown about six months later than the others, was easily the most successful of the grasses. It was evident that with sufficient summer moisture this species could make good growth even under conditions of low soil fertility. Much better growth could be expected if it were grown in association with white clover.

The other grasses were unsatisfactory and appeared to be unable to thrive under any of the fertiliser treatments. The best of a poor lot were tall fescue, Italian rye, cocksfoot and timothy. These species made best growth along the edges of the furrows and around the edges of the clay pans where some deposition of silt had occurred. These should be more satisfactory on the better soils of the irrigation areas.

There were no outstanding differences in the fertiliser treatments. Plots receiving ammonia were somewhat stimulated immediately after application but the duration of the effect was short. It was noticeable, however, that the stock had cleaned out the natural species more on the plots receiving ammonia than on adjacent plots where this fertiliser was not applied.

From the results of this trial, the conclusion arrived at is that, for those who are forced to establish pasture on the type of land under consideration, the best species would be New Zealand white clover and paspalum. White clover 2-4 lb. per acre and paspalum 8-12 lb. per acre should give a satisfactory mixture. White clover may be sown in the early winter or early spring but paspalum would be best sown at the time of the first irrigation.

As a method of establishment the procedure adopted in this trial is not to be recommended. Where undisturbed, there is a hard surface layer on the soil and the germination of seeds is poor. The uneven nature of the surface causes waterlogged patches during the winter and in the summer makes irrigation very difficult and wasteful of water. Good cultivation, on the other hand, would cause better germination and would have some effect in evening the surface.

From data obtained the following scheme suggests itself as worthy of trial on unimproved areas. To loosen the soil and to help even the surface, the land could be ploughed in autumn and a winter crop of oats sown. Following this a

further ploughing would still further even the land and would prepare for the sowing of Sudan grass and paspalum according to the method described by Gibsone and Gauntlett in a previous issue of this Journal (June, 1933). In order to secure good germination and growth of paspalum the seeding of Sudan grass should not be too heavy. After the removal of the Sudan grass, a light harrowing would sufficiently loosen the surface soil for the introduction in the autumn of white clover (2-4 lb. per acre) among the existing paspalum plants. A few pounds of Italian rye grass with the white clover would provide early winter feed but if this were added it would be necessary to completely cover the seed. A good stand of white clover and paspalum should be obtained the following summer.

MARKET REPORT.

Messrs. H. J. Wigmore & Co., Ltd., of Wellington Street, Perth, have supplied the following information regarding Produce available for auction in the Perth Railway Yards, for the period December to February inclusive:—

December.—The supplies of Wheaten Chaff during this month were slightly over the demand, and f.a.q. to prime was selling at from £3 17s. 6d. to £4 per ton, but towards the end of the month supplies weakened, and the market firmed to £4 5s. 0d. F.a.q. was then making £3 17s. 6d. to £4.

Oaten Chaff.—Prime quality was changing hands at £3 17s. 6d. to £4 2s. 6d., and f.a.q. at £3 15s. 0d. per ton.

Oats.—Heavy supplies were arriving, and good heavy feeds were making from 1s. 8d. to 1s. 9d. per bushel; good feeds 1s. 6d. to 1s. 7d.

Wheat.—In the early part of the month under review the market was firm. F.a.q. wheat was selling at 2s. 9½d. to 2s. 10d., but towards the end of the month the market eased to from 2s. 7d. to 2s. 7½d. per bushel, and second grade was making from 2s. 3½d. to 2s. 4½d.

January.—The supplies of Chaff arriving were sufficient to meet the demand, and f.a.q. to prime Wheaten Chaff was realising £4 5s. 0d. per ton; f.a.q. £3 17s. 6d. to £4; prime Oaten Chaff £4 5s. 0d., and f.a.q. £3 17s. 6d. to £4.

Oats.—Good heavy feeds were making from 1s. 10d. to 2s. per bushel, and good feeds 1s. 8d. to 1s. 9½d.

Wheat.—F.a.q. was selling at from 2s. 6d. to 2s. 7d., and there were several consignments of premium wheat sold at 2s. 10½d. to 3s. per bushel. Second-grade made 2s. 3d. to 2s. 4d., and smutty and inferior from 2s. to 2s. 2d.

Barley.—There were fair supplies of good feed Cape and Chevalier Barley finding their way to auction, and same were selling freely at from 1s. 10d. to 2s. 1d. per bushel.

February.—F.a.q. to prime Wheaten Chaff was making £4 7s. 6d. to £4 12s. 6d. per ton, and f.a.q. £4 2s. 6d. to £4 5s. 0d. Prime Oaten Chaff sold at £4 to £4 2s. 6d., and f.a.q. £3 15s. 0d. to £3 17s. 6d.

Oats.—Supplies of Oats were short, and the market firm. Good heavy feeds were making from 2s. 3d. to 2s. 4d. per bushel, and good feeds 2s.

Wheat.—F.a.q. was selling at from 2s. 5d. to 2s. 6d. per bushel, second-grade 2s. 2d. to 2s. 3d., and smutty and inferior at from 1s. 10d. to 2s. per bushel.

Barley.—This was finding buyers at from 1s. 9d. to 2s. per bushel.

LIVE STOCK AND MEAT.

For the information of readers of this "Journal," the following particulars have been supplied by Messrs. Elder, Smith, and Co., Ltd., Perth:—

COMPARATIVE NUMBERS OF STOCK SOLD AT METROPOLITAN FAT STOCK MARKETS FOR MONTHS OF DECEMBER, 1933, JANUARY AND FEBRUARY, 1934

	December.			January.					February.			
	6th.	13th.	20th.	3rd.	10th.	17th.	24th.	31st.	7th.	14th.	21st.	28th.
Sheep ...	10,649	12,869	13,302	11,704	11,544	13,458	11,319	8,331	9,717	10,650	10,834	11,328
Cattle ...	233	602	783	604	702	765	686	650	649	571	615	582
Pigs ...	1,465	1,578	2,266	961	1,230	1,743	1,574	1,236	1,724	1,349	1,232	1,297

COMPARATIVE VALUES PER POUND.

Mutton ...	3¾d.	3¾d.	4d.	4½d.	4¾d.	4¾d.	4½d.	4½d.	4½d.	4¾d.	4¾d.	4¾d.
Beef ...	4d.	4d.	4½d.	4¾d.	4¾d.	4½d.	4½d.	4½d.	4d.	4½d.	4d.	4½d.
Pork ...	6½d.	6¾d.	6½d.	6¾d.	7d.	6½d.	6½d.	7d.	7d.	7d.	7½d.	7½d.
Bacon ...	5½d.	5½d.	5d.	5¾d.	5½d.	5d.	5½d.	5¾d.	6d.	5¾d.	6d.	6d.

METEOROLOGICAL INFORMATION.

Stations.	Temperature.				Rainfall.		Temperature.				Rainfall.		Temperature.				Rainfall.	
	Maximum.		Minimum.		For Month	Average.	Maximum.		Minimum.		For Month.	Average.	Maximum.		Minimum.		For Month	Average.
	Mean.	Highest.	Mean.	Lowest.			Mean.	Highest.	Mean.	Lowest.			Mean.	Highest.	Mean.	Lowest.		
	DECEMBER, 1933.						JANUARY, 1934.						FEBRUARY, 1934.					
					inches.	inches.					inches.	inches.					inches.	inches.
Chapman State Farm	92·6	107·8	62·8	54·0	1·02	·24	95·9	112·1	68·3	57·8	·42	·28	97·8	109·0	69·0	56·0	·01	·42
Geraldton	84·7	105·0	61·7	47·2	·13	·16	86·4	103·0	68·3	59·9	·46	·22	87·7	102·5	70·9	62·0	*Nil*	·28
Walebing	91·2	108·4	61·0	48·1	·16	·17	96·0	114·0	65·1	50·0	1·17	·33	95·4	113·0	65·7	52·0	·23	·49
Perth	83·9	102·8	62·9	52·2	·04	·56	87·8	110·2	66·3	58·6	·27	·34	88·5	108·8	67·4	53·8	·16	·41
Kalamunda	86·3	102·8	59·8	48·7	·09	·78	91·6	108·3	64·0	55·7	·42	·52	89·9	104·3	65·0	51·7	·32	·59
Bunbury	79·9	92·6	57·7	46·7	·14	·57	83·4	93·1	61·5	54·0	·24	·43	84·4	98·0	63·4	45·0	·53	·52
Bridgetown	84·5	97·0	53·0	38·0	·32	·77	89·3	108·0	56·6	42·2	·49	·56	89·7	102·0	55·5	37·2	·20	·75
Albany	73·9	94·0	57·3	49·0	·82	1·18	75·8	88·3	60·9	50·3	1·43	·85	78·0	101·8	60·9	49·8	·76	·91
Merredin State Farm	...	99·2	...	51·3	·87	·52	96·6	110·3	66·0	53·8	·33	·48	96·0	108·6	65·4	49·2	·13	·52
Northam	91·2	107·2	61·3	51·0	*Nil*	·35	95·9	112·3	65·3	54·4	2·12	·27	95·8	112·0	65·7	54·0	·34	·38
York	90·0	106·5	59·5	49·0	*Nil*	·41	94·8	112·0	63·5	53·0	1·35	·30	94·2	108·5	63·7	51·0	·18	·43
Narrogin State Farm	86·8	102·0	54·1	42·5	·18	·54	91·7	107·7	58·9	48·0	·62	·36	91·2	103·3	59·2	43·4	·09	·52
Katanning	83·8	101·6	54·5	44·7	·28	·63	89·2	106·6	58·8	48·7	·40	·38	89·3	102·6	59·1	44·0	·25	·54
Cape Leeuwin ...	72·3	89·6	60·6	56·0	·25	·83	74·1	79·0	63·8	58·0	1·42	·63	76·1	84·4	65·3	58·0	·27	·82

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